BRILL

The Chronology of Roman Trade in the Indian Ocean from Augustus to Early Third Century CE

Author(s): Matthew Cobb

Source: *Journal of the Economic and Social History of the Orient*, 2015, Vol. 58, No. 3 (2015), pp. 362-418

Published by: Brill

Stable URL: https://www.jstor.org/stable/43919248

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at https://about.jstor.org/terms

Brill is collaborating with JSTOR to digitize, preserve and extend access to *Journal of the Economic and Social History of the Orient*

BRILL

JOURNAL OF THE ECONOMIC AND
SOCIAL HISTORY OF THE ORIENT 58 (2015) 362-418

JESHO

brill.com/jesh

The Chronology of Roman Trade in the Indian Ocean from Augustus to Early Third Century CE

Matthew Cobb
University of Wales Trinity Saint David
m.cobb@uwtsd.ac.uk

Abstract

The archaeological and numismatic evidence for Roman trade in the Indian Ocean from the Augustan annexation of Egypt up to the early third century CE shows that the most intense period of contact and exchange was in the late first century CE. The arguments presented here challenge two major positions, which assert either a peak during the Julio-Claudian period or a continuing intensity of contact until at least the late second century CE.

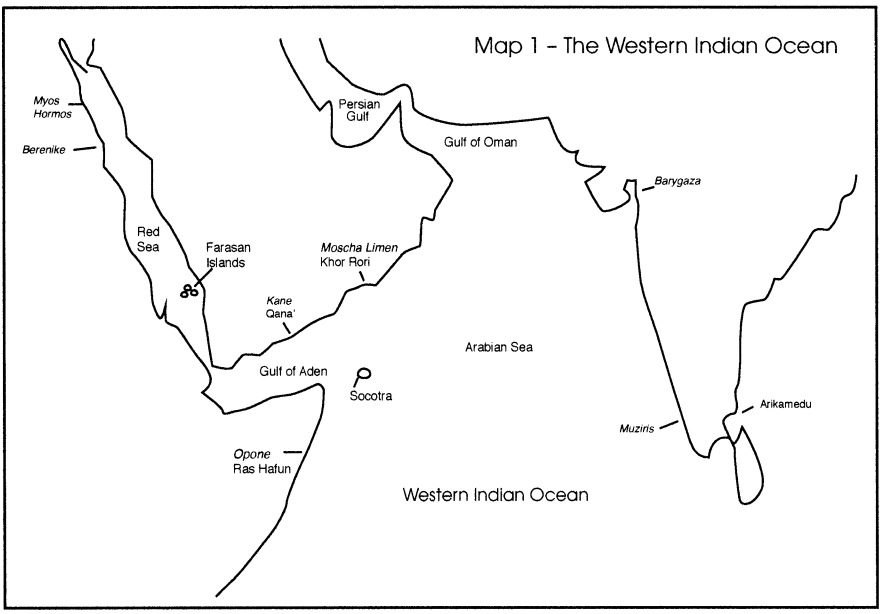
Keywords

Roman Empire – trade – India – amphora – coins

Introduction

For millennia the Red Sea, Persian Gulf, and wider Indian Ocean have facilitated direct and indirect contact between Mediterranean and Middle Eastern societies and lands to the east and south (see Map 1). These networks go back to the Sumerian (Mesopotamian) and Harappan (Indus Valley) civilizations (Bernstein 2008: 31, Moore and Lewis 1999: 52-8, Smith 2009: 32-36, Vogt 1996: 126-27, and Warburton 2007: 9-21) and are later manifested in the interest shown by the Achaemenid kings of Persia in their exploration of routes between northwestern India and the Red Sea (see the voyage of Scylax of Caryanda, in Herodotus, *Hist.* 4.44). Pharaonic Egypt made several state-sponsored expeditions to East Africa and probably also the southern Arabian Peninsula (Curtin 1984: 71-3, Shaw 2000: 316-17, and Smith 2009: 41-5).

© KONINKLIJKE BRILL NV, LEIDEN, 2015 | DOI 10.1163/15685209-12341378



Map of major ports and sites connected to Indo-Roman trade in the Indian Ocean (italics indicates ancient names for ports)

Exploitation of the Persian Gulf and Red Sea continued into the Hellenistic period, under the Seleucid and Ptolemaic empires, respectively. The Seleucids established a colony at Ikaros, on the island of Failaka (near the coast of Kuwait), and developed commercial contacts with the Gerrahaean Arabs, who lived in the eastern Arabian peninsula. This is manifested in the material and coin finds on the island and elsewhere along the eastern Arabian littoral (Salles 1987: 85-8, Salles 1996: 302-4, Sherwin-White and Khurt 1993: 65-6, and Tomber 2008: 112). The Ptolemies also invested much effort in establishing stations in the Eastern Desert of Egypt and ports on the Red Sea coast in order to mine gold and acquire elephants from East Africa for military purposes (Agatharchides 1.1 = Photius, Cod. 250.1, 441b; Strabo, *Geog.* 17.1.5; PEleph 28: see Eide et al. 1996: 572-6; Klemm and Klemm 2013). Even after the acquisition of elephants ceased to be a major concern for the Ptolemies, the use of the Red Sea for commercial purposes continued intensively, as is attested by several offices that were established to oversee such activity in the latter second and first centuries BCE (inscription *OGIS* 132, inscription *SB* V 8036, Mooren 1972: 127-33, Sidebotham 1986: 8-9, 175, and Sidebotham 2011a: 17). Posidonius claims that it was in the late second century BCE that the Greeks first learnt to use

the monsoon winds to sail across the open sea to India.[1] The southwest monsoon enabled merchants travelling from the Red Sea ports to depart in July and reach the Indian coast around the latter half of September and then, with the northeast monsoon, to start the return journey around the end of December and early January (*Periplus Maris Erythraei*, henceforth *PME*, 39, 49, 56, and Pliny, *NH* 6.26.99-105).[2]

These developments directly precede the Roman period of participation in the Indian Ocean trade. The annexation of Egypt by Augustus in 30 BCE meant that the Roman state took over the (attempted) regulation, monitoring, and taxation of the goods entering and leaving Egypt via the Red Sea. This period is the main focus of the present article, in an attempt to discover at what point Roman participation in the Indian Ocean trade appears to peak in the first three centuries CE.[3] It is argued here, on the basis of archaeological evidence from sites across Egypt, East Africa, the southern Arabian Peninsula, and India, that this peak occurred during the first century.[4] It is further argued, on the basis of construction activity in the Eastern Desert and on strongly contested numismatic evidence from India, that this peak is most apparent in the latter part of the first century.

The chronological argument presented in this article is contrary to two broad positions concerning the intensity of Roman participation during this era. One

1 There are two traditions about the "discovery" of the monsoon winds in Graeco-Roman sources. One is related by Posidonius (Strabo, *Geog.* 2.3.4-5), who reports that, after the discovery of a shipwrecked Indian sailor by the Ptolemaic navy, a few expeditions were sent to India under Eudoxus of Cyzicus. The other tradition is vaguely connected to a person known as Hippalos (*PME* 57; Pliny, *NH* 6.26.100, 104-05). For a sceptical view of the validity of these discovery traditions, see Mazzarino 1997: 72-79, Tchernia 1995b: 992-994, and Tchernia 1997b: 250-260; for a more positive view, see Habicht 2013.

2 This pattern of sailing was used by Graeco-Roman merchants. Some other ethnic groups followed different sailing patterns, e.g., the Arabs (Hourani 1995: 26-28, 74); for the patterns of winds and currents, see Düing 1970: 12, 14, 21.

3 The period from the reign of Augustus up to the third century is treated here as a distinct division. This is not to suggest that Roman trade in the Indian Ocean ceases at this point but that the comparative absence of Roman material by the mid third century seems to form a break before a subsequent revival in the Late Antique period. The character of the trade in this latter period shows some distinct contrasts with the earlier period, such as the increasing prominence of ports such as Klysma and Aila and the new significance of Christianity. For Late Roman Berenike, see Sidebotham 2011a: 259-82; for Klysma, see Mayerson 1996: 120 and Young 2001: 77; for Aila and Klysma, see Ward 2007; for spread of Christianity through trade, see Cosmas Indicopleustes 3.42-48, 11.21, 27-28; Tomber 2007a: 219-28.

4 BCE will always be specified, but CE only where ambiguity may arise or specific dates are referred to.

common position has been that the Julio-Claudian period (30 BCE-68 CE) saw the main peak of Roman commercial contact with India. This is an argument made in particular on the basis of the large numbers of Roman gold and silver coins (aurei and denarii, respectively) minted by Julio-Claudian emperors that have been found in India (Bolin 1958, De Romanis 1997, Lebedeva 1988, P. Gupta 1991, Sewell 1904, Suresh 2004, and Tchernia 1997a and 1997b). These arguments and the difficulties inherent in using this numismatic evidence will be discussed in greater depth later in this article. Another common position has been that Roman participation in this trade continued actively at least into the middle of the second century and that it was not until problems such as the Antonine plague (c. 165-180 CE) and the unsettled conditions in Egypt (civil unrest and banditry) arose during the late second and early third centuries that disruption and downturn become apparent.[5] The evidence cited to support this position includes the Muziris papyrus (Cappers 2006, Villeneuve 2007, and Whittaker 2004), the Alexandrian Tariff (Warmington 1928 and Cappers 2006), and the presence of Roman soldiers on the Farasan Islands, in the southern Red Sea (Villeneuve 2007 and Whittaker 2004). The problems with using this evidence will also be examined below.

Before engaging in this debate, however, a few points need to be clarified. First, the Roman annexation of Egypt certainly represents a new political phase in Mediterranean participation in the Indian Ocean trade, but there are questions about the extent of continuity and change between the Ptolemaic and Roman periods and about the pace of change. It is not uncommon to regard the Roman period as ushering in what Seland has termed a new phase akin to ancient globalization or "oikoumenization" in the Indian Ocean (2008: 70-1 and 2010: 2, 18-20), while both Tomber and Sidebotham regard the trade as becoming more systematic, civilian, and commercial than it had been (Tomber 2008: 18, 71, Sidebotham 1991: 15, Sidebotham 1996: 287-8, and Sidebotham 2011a: 5). Some scholars go further and downplay the extent to which the Ptolemaic period saw major developments relating to participation in the Indian Ocean trade,[6] even suggesting that Ptolemaic government

5 For support for the position of a downturn in the late second and third century, see Whittaker 2004: 166, Mukherjee 2004: 4, McLaughlin 2010: 59-60, and Gurukkal 2013: 183; see also Sidebotham 2011a: 63-4, 163 (problems with bandits and plague), Young 2001: 82-86 (increasing problems in late-second to early-third century), and van der Veen 2011: 13 (third-century financial constraints accelerating the decline of Myos Hormos).

6 See, e.g., Warmington 1928: 82 and Fraser 1972: 174, who argue that radical developments took place in the Augustan period (similarly Raschke 1975: 244); see also Strauss 2007: 237-8, who sees little trade before the Roman annexation of Egypt; Parry 1999: 213-4 thinks that, given

monopolies stifled the import of eastern goods, in contrast to the free market that prevailed during the Roman period (Raschke 1975: 244, Whittaker 2004: 163, 167, and McLaughlin 2010: 29, 169). This latter notion should be treated with some caution, as it seems to be based in part on the account of Eudoxus of Cyzicus, who is purported to have brought back goods twice from India and then had them seized by Ptolemaic monarchs. Strabo does not make it clear to what extent the Ptolemies financed these expeditions, but he leaves the strong impression that, on the second voyage, Eudoxus's cargo was seized not under some monopolistic policy but because he attempted to misappropriate part of the cargo (Strabo, *Geog.* 2.3.4, Kidd 1988: 243-244, and Habicht 2013: 199).

It is not within the scope of this article to engage fully in this debate, but it is clear that the scale of Mediterranean participation in the Indian Ocean trade during the Roman period was greater than that preceding it. This is apparent from a range of evidence, such as the archaeological remains indicating the intensity of occupation at the major Egyptian Red Sea ports during this period (Sidebotham and Wendrich 2007, Peacock and Blue 2006a, and Peacock, Blue, and Whitewright 2011). The volume of Roman finds in East Africa, the southern Arabian Peninsula, and India also indicate this (Suresh 2004, Tomber 2008, and Sidebotham 2011a; and see below), and the literary evidence, although impressionistic in nature, seems to complement this picture. For example, Pliny (*Natural History*, bks. 6 and 12) provides a discussion of the schedules and trade routes, as well as the variety of eastern aromatics and spices that could be found at Rome. The anonymous author of the *PME*, a Graeco-Egyptian merchant of the middle first century who participated directly in this trade, provides reliable descriptions of the ports of trade and the goods that could be obtained (Casson 1989: 6-8; Cribb 1992: 131-45; Turner and Cribb 1996: 318; Seland 2010: 13); these included spices, aromatics, cotton, silk, and precious gems, and the export of wine, metalwares, glasswares, and gold and silver Roman coins.

The second point is to identify the cultural and ethnic groups engaged in trade in the Indian Ocean. This article's primary focus is on the intensity of Mediterranean participation in the Indian Ocean trade during the Roman period, but this is not to imply that Roman merchants were the only or even

---

Strabo's failure to mention the port of Barygaza, trade in the Ptolemaic period did not reach India; P. Gupta 1991: 123 argues that Augustus would have taken time to consolidate his hold over Egypt, implying that the trade did not develop fully until the first century CE; Tchernia, 1997a and 1997b, argues for an increasing presence of Italian merchants in trade in the Julio-Claudian period; Whittaker 2004: 21 argues that Roman annexation brought increased liquidity that could finance the trade.

the predominant group engaged in this trade.[7] Indians, Arabians, and Persians, among others, were actively engaged, and those from the Roman Empire who participated were also from diverse backgrounds.[8] There had been a tendency in earlier scholarship to make ethnic assertions about the supposed passivity and non-seafaring character of Indians, in contrast to the proactive Romans, who were seen as the main carriers of goods (Warmington 1928: 1, 10-11, Lindsay 1874: 130, and Wheeler 1954: 1). Such sweeping characterizations are generally absent from more recent scholarship, but in some cases there is a subtle and implicit tendency to see the Romans as the proactive partners (explicitly argued by Gurukkal 2013). For instance, Miller (1969: 217; see also Warmington 1928: 274-85) argued that it was necessary for Roman coins to be exported to some regions of India in order to create a precious-metal currency with which Roman merchants could trade. Carol Meyer (1992: 71) argues that the Indian kingdoms lacked the resources to engage in long-distance commerce, while McLaughlin (2010: 39) speculates that Indians and Arabians who did not own their own vessels probably travelled aboard Roman ships with their own merchandise. It is accepted here, however, that various ethnic groups participated actively in this trade, many of whom already had longed established trade networks preceding the development of more direct Mediterranean participation. This is apparent from a range of archaeological and literary evidence relating to seafaring and the movement of goods.[9]

Third, while the focus of this article is on seaborne commerce via the Red Sea, to which the Romans had direct access, there were also other routes for trade with the East. For example, incense was transported from the southern Arabian Peninsula to centres such as Petra, Bostra, Gaza, Antioch, and Damascus, while various "Silk Roads" stretched from Syria and northern

7 The term "Roman merchant" is one of convenience used to designate subjects or citizens of the Roman Empire who engaged in this trade; it does not specifically designate Romans (from the city itself) or only those with citizenship status.

8 See the Nikanor Archive (*O. Petr.* 200-304), in Tait 1930 and the Berenike ostraca (*O. Ber*), in Bagnall, Helms, and Verhoogt 2000; for graffiti in the Eastern Desert, see Meredith 1952 and 1953 and Bernard 1972; for arguments in favour of the involvement of wealthy Italian financiers and merchants, see Tchernia 1997a, Alston 2007, and Rathbone 1983.

9 For the Indian seafaring tradition see Ray 1995b: 100-1, Deloche 1996: 201-6, Whittaker 2004: 153, Whitewright 2008: 308-9, and Tripati 2011: 1076-7; for Socotra as an international trade hub, see Strauch 2012, Agatharkhides 5.105a + b = (a) Photius, Cod. 250.103, 459b, (b) Diodorus Siculus 3.47.8-9; for the presence of Arabian and Indian merchants at Red Sea ports, see Fournet 2006: 429—*I. Portes* 62, *I. Portes* 91; Bagnall et al. 1979: 244-5, Mahadevan 1996: 205-8, Salomon 1991: 731-5, Sidebotham 1999a: 7, Whitcomb 1982: 67, Whitcomb 1979: 18, Tomber 2000: 624-30, Tomber 2004: 352-3, and Tomber 2005: 226.

Mesopotamia through the Euphrates Valley into Parthian territory (Iraq/Iran) and further into central Asia (Millar 1998, McLaughlin 2010: 83-109, Wood 2002, and Young 2001: 197-200).

The degree of Mediterranean involvement in the Indian Ocean trade via the Red Sea should not be conflated with the wider prosperity of the Indian Ocean trade itself. The distribution and dating of Mesopotamian torpedo jars shows the movement of these wares, almost certainly via the Persian Gulf, in the later Parthian (c. 1-224 CE) and Sassanian (224-651 CE) periods (Tomber 2007b: 974, 977-82). It is clear that Eastern goods were brought to the Roman Empire via the Persian Gulf and riverine and overland routes through Mesopotamia. This sphere was under Parthian suzerainty, and the limited knowledge and discussion of the Persian Gulf in the *PME* suggests that Roman merchants were not, generally speaking, involved directly in this region (Salles 1995: 115-46, Millar 1998: 120-1, Young 2001, Rougé 1986: 41-44, and Potts 1990, 2:2-6, 10-12, 20-22). A limited amount of Roman material has been found at sites in the Persian Gulf, notably at ed-Dur, such as Eastern Sigillata A ware (40 BCE to 60-70 CE) from Syria, B1 from the Levant, and C from Asia Minor (second half of first century CE), as well as Roman lamps from the Levant and Egypt and green lead-glazed ware from Asia Minor (Rutten 2007: 9-12, 15-6). Nevertheless, as noted by Rutten, the difference between the pottery assemblage of southern Arabia and that in the Persian Gulf confirms the *PME* in showing that the Egypt-Arabia-Indian route was separate from the Persian Gulf route; the few vessels brought up from southern Arabia were probably imported in "piggy-backing" trade, as personal property or souvenirs (2007: 9-18).

While "Roman merchants" generally did not use the Persian Gulf route, merchants from the semi-independent state of Palmyra—within the sphere of Roman influence but not directly controlled until the reign of Aurelian, 270-75 CE—certainly did. Two inscriptions indicate that a 25 percent tax was levied by an official (the "collector of the fourth") on imported Eastern goods (Healy 1996: 34, Inv. X.29, Inv. X.113), a situation that parallels the collection of a 25 percent tax at Alexandria (see below) and at Leuke Kome (*PME* 19).[10] There are also several dedications in Palmyra that refer to Palmyrene officials accompanying caravans to Vologesias (near Ctesiphon) and Charax, the main mercantile centre of the Tigris and Euphrates deltas (Healy 1996: 35-6 and Young 2001: 151-4). The epigraphic evidence for Palmyrene activity via Mesopotamia and the Persian Gulf is substantial for the reigns of Trajan and Hadrian, but there is a notable dearth around 161-193 CE, and this trade is likely to have been affected

10 For the debate about whether this tax was collected directly by Roman officials at Leuke Kome or was collected locally, see Bowersock 1983: 71 and Casson 1989: 145.

by Roman conflicts with Parthia under Lucius Verus, as well as later emperors such as Septimius Severus and Caracalla. Subsequent conflicts between the Romans and Sassanids probably further hampered this trade, as attested by the absence of references to Charax from this time, although an expedition to Vologaesias is recorded (Inv. III.29 = CIS II.3949, Gorea 2012b: 464-5, and Young 2001: 173-5).

1 Strength of the Trade in the Second and Third Centuries?

Before laying out the case for a late-first-century peak in Roman participation in the Indian Ocean trade, it is necessary to examine the evidence cited by those who argue that it continued at similar levels of prosperity until at least the middle to late second century. The Muziris papyrus is one document that has been used to make this case (Cappers 2006: 5-6, Villeneuve 2007: 18, 26, Whittaker 2004: 21). Dating broadly to the middle second century, this document records a loan made at, or for the purpose of acquiring goods from, Muziris (Pattanam) in southern India (*P. Vindob* G 40822v., Casson 1986, and Rathbone 2000). The verso of this document records a consignment of ivory, cloth, and nard weighing 3.5 tons and valued (after a small tax deduction) at 1154 Egyptian talents and 2852 drachmae (almost 7 million sestertii). Rathbone argues that such large sums were usual because he regards the Muziris papyrus as representing a copy of a standard contract, on the basis of its careless grammar, syntax, and general sloppiness, implying that its form came from a boilerplate (2000: 41). The contract may well have been a standard one, but the lack of comparable documents makes it difficult to be sure that such sums were common. Even if the value of the cargo of the Hermapollon is regarded as common for the middle second century, the Muziris papyrus alone does not tell us whether the volume or value of the trade was similar to or greater or smaller than that of earlier periods.

Another piece of evidence that has been cited to suggest the continuing importance of trade via the Red Sea during the late second century is an imperial rescript of Marcus Aurelius and Commodus, known as the Alexandrian Tariff, preserved in the Late Antique *Digest* of Justinian (39.4.16.6-7, *Marcianus 1.S de delatoribus*). This rescript mentions a *uectigal* (tax, duty) to which many goods were liable at Alexandria. These include several spices and aromatics, probably acquired via the Indian Ocean, and items such as Indian iron, eunuchs, and hair! Also referred to are Assyrian drugs, Persian gum, Tyrian cassia, and North African wool.

Some scholars have compared the various goods cited in the Alexandrian Tariff and the *PME*, noting that, of the 20 plant products mentioned in the

former, only nine appear in the mid-first-century *PME* (Warmington 1928: 184-85, Cappers 2006: 3, 5-6).[11] It is not clear, however, that such a comparison tells us much about the overall state of the trade between the two periods. To begin with, the lack of reference to a particular good in the *PME* is not an indication that it was not traded, as finds of Roman metalwares and glasswares across the Indian subcontinent indicate (the *PME* mentions only raw glass and metals to Barygaza, Muziris, and Bakarē; Cobb 2011: 211-15, 216-20). Furthermore, the Alexandrian Tariff does not deal exclusively with Indian Ocean goods[12] and therefore cannot be assumed to represent all Indian Ocean goods liable to tax.[13] While these sources may give us an idea of some (but not all) of the goods being traded in the middle first (*PME*) or the late second century (Alexandrian Tariff), it is not possible to infer from the variety of goods mentioned anything about the volume in which they were traded.

The presence of Roman soldiers on the Farasan Islands has also been cited by Villeneuve, along with the Muziris papyrus, as an indication of the importance of Roman trade in the Indian Ocean by the middle second century (2007: 18, 26; see also Whittaker 2004: 21). The presence of these soldiers is mentioned in two Latin inscriptions. The first, from Farasan al-Sughra, dated to 144 CE, records the presence of a *vexillatio* of the Legio II Traiana Fortis. The second, more fragmentary inscription, from Farasan al-Kubra, mentions the Legio VI Ferrata; it is thought that this detachment may have come while the legion was in Arabia around 110-120 CE (Villeneuve 2007: 24-5). These islands are about 1000 kilometres south of the Roman Red Sea port of Berenike and strongly indicate that there was a Roman naval presence in the Red Sea in this period. Reference to a Lucius Longinus who served on the *Hippokampos*, a dispatch galley (*tesseraria*) mentioned in a papyrus from Myos Hormos (93 CE), support this view. It has been reasonably suggested that they were there to protect the merchants from pirates and to prevent smuggling (Villeneuve 2007: 25),[14] but broader strategic concerns may also have been an important motive for the

11 The nine corresponding goods are costus, cassia, aloe, lykion, myrrh, malabathron, black pepper, long pepper, and nard.

12 McLaughlin 2010: 105 speculates, on the basis of the third-century Chinese text the *Weilue*, that goods from Persia may theoretically have been shipped through the Persian Gulf, around the Arabian Peninsula, and up the Red Sea and thus sees the Alexandrian Tariff as dealing exclusively with Indian Ocean imports. However, the presence of Levantine and North African items make this less likely.

13 Young 2001: 209 has noted that nothing in the Alexandrian Tariff indicates that it can be equated with the *tetarte*, the 25% tax that was levied on Indian Ocean goods at Alexandria.

14 For the *tessararia*, see P.004, Van Rengan 2011: 335-6.

presence of these troops; it cannot be asserted that they were there solely to protect merchants and combat pirates.

Finally, the presence of Palmyrenes at several sites connected with the trade via the Red Sea around the late second and early third centuries needs to be addressed. At Koptos, there is an inscription dating to the second half of the second century that records the gratitude of a group of merchants from Hadriane Palmyra, to Zabdalas, son of Salmanos, a merchant of the Red Sea, who had paid for the construction of a *propylaea*, three *stoae*, and *thuromata* from his own funds (*I. Portes* 103, Young 2001: 80-81). This inscription attests to the presence of a community of Palmyrene merchants at Koptos and, as Sidebotham has suggested, more tentatively, a Palmyrene merchant headquarters (1986: 95; also Sidebotham 2011a: 211-12). In addition, a Greek and Palmyrene inscription at Dendereh (c. 160-212 CE) refers to Julius Aurelius, who was part of a community of merchants and *naukleroi* (captains and/or shipowners), complementing the evidence from Koptos (Sidebotham 1986: 95-6, Sidebotham 1989: 487, and McLaughlin 2010: 105). The discovery of a wooden tablet with Palmyrene text at Hoq, on the island of Socotra (a few hundred kilometres from the Horn of Africa), reinforces the evidence that Palmyrene merchants were trading via the Red Sea in the third century CE (Gorea 2012: 452-3, and Dridi 2012: 461-2).[15]

One reason for this Palmyrene presence may be the hostilities between the Roman and the Parthian/Sassanian empires during this period, which appear to have affected their trade via the Persian Gulf (see above). The presence of these Palmyrene merchants parallels the presence of Palmyrene soldiers (specialists in desert warfare). This can be seen from an inscription at Berenike recording a dedication to the Emperor Caracalla (8 September 215) by the auxiliary soldier Marcus Aurelius Mokimos and from two dedications to the Palmyrene god Yarhibol at Koptos and Berenike, which probably date to the late second and early third centuries (Alston 1995: 188, Alston 2007: 4, Verhoogt 1998: 193-8, and Sideobtham 2011a: 63-6). Whether the presence of Palmyrene soldiers acted as a motivating (or facilitating) factor in the apparent increase in the presence of Palmyrene merchants at this time would be difficult to prove, but it is not difficult to imagine a connection. These inscriptions provide useful snapshots for Palmyrene activity at particular points in time but, like the evidence examined above, do not lend themselves easily to revealing broader trends in the intensity of Roman trade. The more limited evidence for Palmyrene involvement in

15 The date of July AD 258 has been proposed from a textual reading and that of AD 78-239 from radiocarbon dating. If the textual date stands, the text was written on wood obtained from a tree at least twenty years earlier.

the Red Sea trade during the first century is hardly evidence for smaller-scale trade at this time.

The caveats about the various pieces of evidence discussed above are not intended to suggest that Roman participation in the Indian Ocean trade ceased or became negligible beginning in the second century, only that this evidence is not useful for determining the volume of trade at this time. Instead, it is argued that Roman participation in the Indian Ocean appears to reach a peak in the latter half of the first century and that, after this time, the volume of Roman trade appears to decline. This argument is made on the basis of patterns interpreted from the archaeological and numismatic evidence found across various regions involved in the Indian Ocean trade. The nature and spread of this evidence can provide a broader indication of trends.

2 Archaeological Evidence: Roman Goods

Because the trade was international, archaeological excavations have been conducted at many sites, with the result that standards and thoroughness in the recording of material has not always been consistent. Suresh has noted such problems in earlier excavations in India, which often focused on recovering antiquities rather than examining settlement patterns (2004: 21). Another problem is the extent and intensity of archaeological work undertaken in the various regions; the fieldwork undertaken in East Africa has been more limited than that in Egypt, the Arabian Peninsula, and India. Such imbalances may complicate attempts to draw quantitative conclusions about the volume of trade to particular regions.[16] The examination of the archaeological material can, however, at least provide statistical data for the number of finds and their chronology at individual sites. This permits the comparison of chronological patterns seen at particular sites in order to determine broader trends. The surviving material from various sites across East Africa, the southern Arabian Peninsula, and the Indian subcontinent strongly suggests that the most intense period of contact and exchange of Mediterranean goods, whether conducted by Roman merchants or other groups, was the first century and that there are indications of decline by the early second century.

The more limited material from East Africa generally shows that the most intense period of contact was from the first century BCE to the first century CE. In particular, the glassware at Heis (Munda of the *PME*?) belongs to the first

16 Similar issues beset the quantification of the archaeological material in the Roman Empire; see Wilson 2009: 214 and Bowman and Wilson 2009: 7-15.

half of the first century, while the occupation at Heis, Damo, and West Hafun (Opone of the *PME*?) seems to be limited to the late Ptolemaic and early Roman periods (Smith and Wright 1988: 124 and Horton 1996: 447-50). It has been suggested that some beads found on Mafia Island and at Kilwa may be Graeco-Roman and date to around 100 BCE-200 CE (Chami 2000: 211; see also Sinclair 2007: 148), but this interpretation has not found favour elsewhere, and it has been argued that these types of glass beads were probably imported (and reworked) beginning in the late first millennium CE (Helm et al. 2012: 40, 58-9).

More easily identified are pottery forms, which can often be narrowed down to a more limited time period. This is exemplified in the recent survey at Adulis, an important port mentioned by the author of the *PME* (4-6; see also Pliny, *NH* 6.34.172-74 and Cosmas, *Christian Topography*, book 2). The Roman pottery found in several areas associated with this port appears to date mainly from the first century BCE to the first century CE (principally Dressel 2-4 and Eastern Sigillata A) or the Late Antique and early Byzantine period (notably Late Roman 1 and 2, and pottery from Aila). The only possible bridge between these two periods is a handle fragment of a possible Gauloise 4 amphora, from between 50 CE and the third century (Peacock et al. 2007: 79-108 and Peacock, Blue, and Glazier 2007: 126-8).

Several sites in the southern Arabian Peninsula have revealed finds of Roman goods. At Qana' (Kane of the *PME*) the pottery types found in the earliest or "lower" period (middle first century BCE to late first century CE) are predominantly Mediterranean imports. In this section, about 56 percent of the amphora fragments are Koan and Dressel 2-4 shapes in several fabrics, including Koan or east Aegean, Egyptian, and a dark red sandy clay. Some of these amphorae fragments are similar to types found in Italy. Terra Sigillata from the earliest period is mostly Eastern Sigillata, although some is possibly of western Mediterranean origin (Sedov 1996: 12-6). Occupation at Qana' continues into the "middle" (second to fifth centuries) period, the site's heyday, and the "upper" period (sixth to early seventh centuries). The Koan and Dressel 2-4 types disappear before the middle period, but Roman amphorae continue to appear, particularly in the form of North African and "North African-Gallic" wares. The overall picture seen at Qana' is characterized by Sedov as one in which trade connections with the Mediterranean had diminished by the late first century CE, but had been "re-activated" during the second to fifth centuries, although "not at the same level as before"; this "reduction of Mediterranean objects" occurred when the port was expanding and an increasing amount of Mesopotamian and Indian wares were being imported (Sedov 1996: 16-9 and Sedov 2007: 76-89, 92, 104). This is a further reminder that Roman participation in the Indian Ocean trade does not necessarily indicate the wider

prosperity of trade within the Indian Ocean as a whole. At ed-Dur, on the Persian Gulf, Roman finds conform to the dates seen generally elsewhere in the Indian Ocean, between the last quarter of the first century BCE and the end of the first century CE (Rutten 2007: 18-20). The Mediterranean glassware at Khor Rori (Moscha Limen of the *PME*) also dates between the middle first century BCE and the early second century CE (Lombardi, Buffa, and Pavan 2008: 402).

In the Indian subcontinent (including Pakistan and Afghanistan) a range of Roman finds has been recorded. Among the most numerous (along with coins) is pottery, primarily amphorae. Most estimates are that at least 50 sites report Roman amphorae, with Dressel 2-4 types being the most commonly recorded.[17] Not all of this material has been dated, but, from the sites where more detailed study and analysis has been undertaken, the pattern seems to show a predominance of amphorae of the first century BCE to the first century CE. This pattern is apparent from the port of Arikamedu (near Pondicherry), in southeastern India, where several hundred amphorae sherds, mostly Koan and Dressel 2-4, are attested. Mediterranean finds from this site dwindle by the end of the first century and the beginning of the second century (Begley 1996: 12, 22, Begley 2004: 9-10, and Will 2004: 328). At Pattanam in Kerala, thought to be the ancient Muziris, thousands of amphora sherds have been unearthed. This material is still being processed, but most remains appear to be Dressel 2-4 types dating from the late first century BCE to the first century CE (Abraham 2009, 18, 21, Selvakumar, Shajan, and Tomber 2009: 35-6, Cherian et al. 2009: 236-40, Cherian 2009-10: 154-5, and Sidebotham 2011a: 191). Detailed examination of some of the 63 Roman amphora sherds unearthed at Nevasa, in Maharashtra in western India, show that they have the "black sands" fabric typical of Campania (Gupta, Williams, and Peacock 2001a: 11-4). The layers in which they were found date to between 25 BCE and the early second century CE, but Williams and Peacock (2005: 140-8) have argued elsewhere that such amphorae probably predate 79 CE, given the damage done to the Campania wine industry by the eruption of Vesuvius in that year.

Metalware and glassware finds in the Indian subcontinent also conform to the broad patterns seen in the Roman pottery. At Bagram (Afghanistan) numerous items of Roman glassware, earthenware, and bronze objects were discovered sealed together in two rooms (Hiebert 2011: 62-63, Mehendale 2011: 131-32, 140-3, and Cambon 2011: 149, 152, 160-1). Whitehouse believed that, stylistically, many of these glass objects may range in date from 50 to 125 CE

17 For various estimates, see Agarwala 1985: 5, Slane 1991: 212, Thapar 1997: 13, Suresh 2004: 99, 182-3, App. 3, Will 2004: 334-404, and Tomber 2009: 48. Ray 2010: 10 states that about 55 sites in India have Dressel 2-4.

(1989a: 151-7 and 1989b: 94-6), but recent interpretation has dated them firmly to the first century, and some of these finds, like the ribbed bowls, show parallels to finds at ed-Dur and Arikamedu.[18] Further parallels between the finds at Bagram and those at Taxila/Sirkap (Pakistan), as well as parallels with both sites to Tillya Tepe (Afghanistan), suggest that the finds from Taxila/Sirkap can also be dated to the first century (Cambon 2011: 160-1, Sarianidi 2011: 214, and Schiltz 2011: 225-7).

3 Archaeological Evidence: The Red Sea and Eastern Desert of Egypt

3.1 *Red Sea Ports*

In addition to the patterns indicated by the dates and distribution of the Roman goods just discussed, the archaeological and written evidence from the Red Sea ports of Myos Hormos and Berenike are important indicators of the intensity of Roman participation in the Indian Ocean trade. A variety of literary, papyrological, and epigraphic evidence reveal that these were the two main ports through which Roman trade in the Red Sea was conducted and that Koptos was the main centre on the Nile where these goods were shipped and received.[19] The importance of these two ports is further indicated by stations that were established on the routes leading from Koptos to Myos Hormos and Berenike (see below).[20]

The port of Berenike, located on Ras Banas, a peninsula in Foul Bay, was founded by Ptolemy II (Pliny, *NH* 6.33.168). The archaeological and written evidence reveals the fluctuating prosperity of this port from the third century BCE to the middle sixth century CE. The evidence suggests that the first century was a peak period of prosperity, which was followed by a dramatic decline in occupation after the early second century and a modest recovery beginning in the middle fourth century (Sidebotham, Hense, and Nouwens 2008: 161-2,

18 All pieces are Roman, as they display a similar chemistry and probably originated in Egypt; see Cambon 2011: 152-3, Suresh 2004: 134, Brancaccio and Liu 2009: 222, and Mehendale 2010: 131-5, 140.

19 See literary description in Strabo, *Geog.* 17.1.45 and Pliny *NH* 6.26.102-3; an inscription of tolls for travellers across the Eastern Desert: Koptos Tariff, *OGIS* 674 = *IGRR* I. 1183 = *I. Portes* 67; the Muziris papyrus mentions a customs house at Koptos (*P. Vindob.* G 40822 recto, col. 2.4-9); for delivery of goods to Myos Hormos and Berenike, see the business receipts of Nikanor family (Nikanor Archive, *O. Petr.* 200-304), and the customs receipts found at Berenike (*O. Ber*).

20 For Myos Hormos, see Peacock and Blue 2006a; for Berenike, see Sidebotham and Wendrich 2007 and Sidebotham 2011a.

171-2, and Barnard and Rose 2007: 183). In particular the coin finds at Berenike reflect these fluctuations in prosperity and intensity of occupation at the port; 41 percent of the coins were minted during the Augustan period and in the first century, the majority being issued in the reigns of Claudius, Nero, and the Flavians; only 9 percent date to the second and third centuries.[21] Cartouches dating to the reigns of Trajan and Marcus Aurelius at the temple of Khem at Berenike, as well as an inscribed military dedication at Berenike around the late second to early third century (see above) indicate that activity at the port had not ceased at this time (Sidebotham 1986: 158-9, Sidebotham 1989: 490, and Sidebotham 2011a: 63-4, 211-2), but the patterns of the intensity of occupation at this site suggest that fewer goods were coming through this port than during the first century.

The port of Myos Hormos, at modern Quseir al-Qadim, was founded during the Ptolemaic period.[22] The site was apparently abandoned by the early third century, due to silting, partial submergence, and possibly, indirectly, the series of crises faced by the Roman Empire in the third century, although the site would be reused later, during the Ayyubid and Mamluk periods (Whitcomb 1979: 37 and Blue 2007: 265, 274-75). Like Berenike, various parts of the port of Myos Hormos show signs of disuse and abandonment during the second century. The harbour area at Myos Hormos, which includes a jetty and workshops (notably iron-smelting furnaces), shows considerable activity in the late first century BCE and the first century CE. The jetty and several of these workshops appear, however, to have fallen into disuse during the second century (Copeland et al. 2006: 116-54, and Peacock et al. 2006: 67-94; see Appendix 1).

In the town area at Myos Hormos, some of the Roman material has been mixed with the Islamic material as a result of the digging of pits in later phases of occupation. Nevertheless, the excavators were still able to determine patterns of occupation. The town area includes civic and religious buildings, domestic and commercial storage areas, a "poor quarter," a bakery, and waste mounds (C. Meyer 1982: 201-13, Copeland et al. 2006: 118, 121-6, 128-33, Peacock and Blue 2006b: 176, and Tomber 2008: 61). The chronological picture is less

21 Sidebotham 2011a: 244: 34% of the coins date to the fourth to fifth centuries and are almost exclusively Egyptian; see also Sidebotham 1999, Sidebotham 2000: 169-78, and Sidebotham and Seeger 1996.

22 Agatharkhides 83a + b + c: (a) Photius Cod. 250.80, 456a = (b) Diodorus 3.39.1-2 = (c) Strabo, *Geog.* 16.4.5; see also Strabo, *Geog.* 2.5.12. For the identification of the ports, see Peacock 1993: 229-30 (satellite analysis); on ostraca from Maximianon, see Bülow-Jacobsen, Cuvigny, and Fournet 1994: 27-42 (*O. Max.* 175, 253, 254, 267, 279, 467); for Myos Hormos, see papyrus P.004 in Van Rengan 2011; Tomber et al., 2011.

clear, but there were significant buildings being constructed and occupied during the first century, followed by disuse and lack of maintenance during the second century. Many refuse dumps show concentrations of first-century material, although one area also shows occupation material peaking in the middle second century, with even a little third-century material (Copeland et al. 2006: 116-54 and Peacock et al. 2006: 67-94). Some of the finds also seem to conform to this pattern, with most of the amphora stoppers, ceramic lamps, brail rings, and terracotta figurines dating from the Augustan period into the first century (Thomas 2011a and b, Peacock 2011a, and Blue, Whitewright and Thomas 2011: 208-09). Most of the written evidence (primarily as papyri and ostraca) dates to the first and second centuries, while about two-thirds of the identifiable coinage was minted in the Augustan period and first century (Van Rengan 2011; Sidebotham 2011b; see Appendix 1).

3.2 *Fortifications and Security in the Eastern Desert*

Several stations or small forts (*praesidia*, sing. *praesidium*) lined the routes leading from Koptos on the Nile to the ports of Myos Hormos and Berenike. These praesidia may have acted as places of refuge and as protection for the wells (*hydreumata*) and cisterns (*lakkoi*) located in them (Cuvigny 2006b: 267-73 and Cuvigny 2006c: 353-57). Garrisons of cavalry and infantry were housed in these praesidia and, on the evidence of duty rosters, may have numbered 22-24 men on average (Cuvigny 2006c: 307-10). Some ostraca from the praesidium of Krokodilo (on the Myos Hormos route) refer to soldiers escorting travellers, although not always in large numbers and often on the explicit instructions of the prefect in charge of the region (Praefectus Montis Berenicidis), rather than as a matter of course. These soldiers probably had the additional function of monitoring smugglers, who may have sought to transport valuable goods across the Eastern Desert without being taxed (Cuvigny 2005, Cuvigny 2006d,e, and Young 2001: 69-74).

Many of the dozen or so praesidia lining the route to Myos Hormos have been excavated under the auspices of the Institut Français d'Archéologie Orientale and show evidence for occupation primarily from the Flavian period (69-96 CE) onwards (Reddé and Brun 2006: 73-185 and Brun 2006a: 187-205). Several ostraca have been unearthed from these praesidia, especially Maximianon and Krokodilo; the latter praesidium yielded ostraca dating from 102/3 to 118 CE (Brun 2006b. 61-71). Inscriptions at various praesidia on the route from Koptos to Berenike also indicate that the Flavian period was a time of major (re)construction. One inscription from Sikyat describes how, in the ninth year of Vespasian (76-77 CE), the prefect of Egypt, Iulius Ursus, ordered the construction of a well there. Cuvigny notes that the language used in this

inscription parallels almost word for word that seen on a more lacunose one from Aphrodito, suggesting that the building activity at this site also belongs to the Flavian period.[23] Another inscription, at the praesidium of Didymoi, reveals that this fort was established on the orders of the prefect of Egypt, Mettius Rufus (89-92 CE) (Brun 2006a: 19).

These routes were certainly in use before the Flavian period, as attested by numerous graffiti left at stopping points in the Eastern Desert and comments by Strabo showing that stations had existed since the time of Ptolemy Philadelphus (283-246 BCE).[24] The Flavian period was, however, clearly a time of major building activity. It has been suggested that this was due to the growing threat posed by nomads to those crossing the Eastern Desert, possibly as a result of the increasing use of camels, which allowed more effective raiding.[25] In particular, Cuvigny cites an inscription (two of the six slabs of which survive) that refers to Roman military personnel who, over several months, constructed cisterns at Apollonos Hydreuma, Compasi, and Berenike and a camp at Myos Hormos. They also record the soldiers' names and the centuries and cohorts to which they belonged.[26] Cuvigny argues that, because the inscription refers to the creation of lakkoi rather than praesidia in the Eastern Desert, it shows that unfortified cisterns were all that was required in the Julio-Claudian period (Cuvigny 2006b: 267-73 and Cuvigny 2006c: 353-7). This inscription is often thought to date to the reign of Augustus or Tiberius, but the dating is uncertain, leading to debates concerning the soldiers' names and who granted many of these eastern legionaries their citizenship.[27] Such an approach is inconclusive, but, given the construction work taking place at Sikyat, Iovis, and Didymoi during the Flavian period, it is possible that the lakkoi constructed at Compasi and Apollonis Hydreuma also dated to about the same time (Sidebotham 2011a: 154 and Cobb 2011: 86-90).

---

23 For these inscriptions, see Cuvigny 2006c: 356 and Aphrodito inscription, *I. Pan* 68.

24 See Bernard 1972: 15; Young 2001: 41; *I. Koptos* 3, 38-39 (Augustus); 41, 42, 43, 44, 45, 46, 47, 48, 49 (Tiberius); 1 (Claudius); 50 (Nero); 51 (Titus); 52, 53 (Domitian); 4, 5, 54, 55 (Hadrian); 56 (Antoninus); 57 (Maximinus Thrax); Strabo, *Geog.* 17.1.45.

25 See Brun 2006a: 196; Strabo, *Geog.* 17.1.53; on the use of camels, see Murray and Warmington 1967: 29.

26 For discussion, see Kennedy 1985: 156-7, Young 2001: 44, Alston 1995: 30, and Syme 1995: 249.

27 Syme 1995: 249 suggests an Augustan date due to the presence of two legionaries with the name Lollius, both from Ancyra (M. Lollius was legate of Galatia in 25-22 BCE); Alston 1995: 30 suggested that the presence of a soldier named P. Flavius son of P., indicates a Flavian date; contra Alston 2007: 3.

Whatever the date of this inscription, the archaeological evidence, ostraca, and other inscriptions, strongly suggest the need to (re)construct and fortify the facilities on the routes from Koptos to Myos Hormos and Berenike during the latter first century. That one of the major reasons for this was the threat posed by some of the indigenous groups of the Eastern Desert is supported by several ostraca from the praesidium of Krokodilo, which reveal the sometimes tense relations between the soldiers and inhabitants of the praesidia and the indigenous groups referred to as *barbaroi* (barbarians) in these texts (Cuvigny 2005). One ostracon records the theft of several camels by 18 barbaroi and an injury sustained by the cavalryman Lucretius Priscus who was part of a group chasing after them (108 CE), while another report warns the soldiers to be on their guard.[28] There are several accounts besides these.[29] Other evidence also indicates that the Roman military took systematic action against some of these indigenous groups. One papyrus (c. 60-94 CE) refers to an engagement between the Roman military and Ethiopians and Trogodytae (the latter a vague term for inhabitants of this region).[30] One Sulpicius Serenus (possibly Servius, tribune of Legio XXII and prefect of Ala Voconces) has left an inscription giving thanks for a speedy victory over the infamous Agriophagoi (Wild-Animal Eaters) who were massacred and whose camels and booty were seized.[31]

It has been argued above that the peak of Roman participation in the Indian Ocean trade and the exchange of Roman goods in this region seems generally to date to the first century. It will be argued in the numismatics section below, that this peak is most pronounced in the Flavian period. Therefore one of the causes of this apparent increase in hostilities and need for security in the Eastern Desert must have been the increase in traffic and hence further encroachment onto the land and resources of the indigenous population, as well as the many tempting targets for plunder.

4 Numismatic Evidence: Roman Coins in India

Many Roman aurei (gold coins) and denarii (silver coins) have been discovered in the Indian subcontinent, most of them in hoards but some also as surface

28 See Cuvigny 2005: 36, K534 (raid by barbarians) and 96, K694 (be on guard).

29 For hostile interaction with the barbaroi, see Cuvigny 2005: 135-58, esp. *O. Krok.* 87 (the "amphora of the barbarians") which records an attack on the station of Patkoua in Lower Nubia by 60 barbaroi.

30 See E. Turner 1950: Papyrus 40 "della raccolta Milanese (Collezioni del Castello di Milano)."

31 See Cuvigny 2006c: 348-9, *I. Pan* 87; see also *PME* 2.

finds and some in excavations. Few of these types of coins have been discovered in East Africa or the southern Arabian Peninsula, but the author of the *PME* does mention demand for them in various ports across these regions. The terms used are *dēnarion* (denarius) and *khrēma* and *khrēmata* (money), often modified by the adjectives "gold" and "silver."[32] It is difficult to know how much gold and silver was exported from the Mediterranean in the form of ingots, but, given that the author of *PME* chose to refer explicitly to the export of these precious metals in the form of coins or money and as crafted gold and silver items—which were, no doubt, valued not as bullion but as high-quality artistic objects—it seems reasonable to believe that coins were a common and practical medium for the export of precious metals and are likely to have been regarded, at least in part, as bullion by the recipients (Sidebotham 1986: 46, Sidebotham 2011a: 245, Young 2001: 205, and Cobb 2011: 220-3, 230).

The discovery of Roman coins in India raises some problems of interpretation. Many of those discovered, particularly before the mid-twentieth century, have been lost, stolen, or redistributed to collectors and museums without adequate documentation, often forcing scholars to rely on written accounts and published photographs.[33] An example of such problems is seen in the discovery at Kottayam (in Kerala) in 1847 of a bronze vessel on a hillside by the coast. This vessel was said to have contained gold aurei, which have since been lost. The nineteenth-century accounts state that the find was equivalent to no less than five coolie-loads, which Turner equates to about 8000 aurei.[34] There are also problems with corrosion (to which silver is more susceptible) and preservation. The Akkenapalle and Budinatham denarii survived in lumps surrounded by a congealed mass of silver sulphides, while the coins on the inside were protected from the air and thus remained uncorroded (P. Turner 1989: 14-5 and Howgego 2009: 291). Despite these difficulties, there is sufficient information to interpret patterns from these coins, especially those in hoards.

In the Indian subcontinent there are approximately 170 recorded finds of Roman coins dating from Augustus to the early third century, spread over

32 *PME* 6, 8: East Africa: for the barbaroi, a little Roman money (*dēnarion oligon*), at Malaô, Roman money both gold and silver (*dēnarion ou polu, kai, khrusoun de kai arguroun*) 24. Southern Arabia: at Muza, money (*khrēma*), 39, 49, 56. Indian subcontinent: at Barbarikon, money (*khrēma*), at Barygaza, Roman money (*dēnarion khrusoun kai arguroun*), and Muziris and Bakarē, lots of money (*khrēmata pleista*). For a commentary on the text, see Casson 1989: 29-31, 122, 209, 220.

33 For plates with images of some of these coins, see Turner 1989 and Radhakrishnan 1999.

34 P. Turner 1989: 8-9, 62 suggests a minimum estimate of 25 pounds being carried per coolie (manual labourer) so conceivably the figure could be even higher; see also Suresh 2004: 26, 170-1 who suggests the figure of 10,000 aurei.

about 130 sites. Two regions, in particular, show major concentrations of Roman coins. The first is of primarily Julio-Claudian denarii in the Coimbatore district (in Tamil Nadu, in southern India); this is the area around the juncture of the Cera, Pandya, and Cola kingdoms. The second concentration is in the area of the Krishna River (in Andhra Pradesh, eastern India), consisting predominantly of post-Julio-Claudian aurei (Suresh 2004: 26, 31 and P. Turner 1989: 5). Republican denarii have been found at a few sites, mostly in western areas such as the Laccadive Islands and Kerala (Singh 1988: 101 and Suresh 2004: 153-4). Large numbers of bronze coins, mostly of Late Antique date, have been discovered in Sri Lanka, and several gold solidi (dating from Constantine onwards) have been found in various parts of India (Bopearachchi 1996: 68-70; Suresh 2004: 38-40). These Late Antique coins do not fall within the scope of this article.

Some of these coins have features such as slash marks and punch marks, while imitation coins, both of high quality (near parity in weight and purity) and in silver-coated base metals, have been found. Most of these features and imitations are thought generally to have originated in India, although their purpose is open to much debate, with suggestions ranging from checking for purity to invalidating coins for circulation, authorising coins for circulation, identifying markers, and supplementing genuine Roman coins in order to circulate as currency (Warmington 1928, P. Turner 1989, Suresh 2004, Shastri 2004, Satyamurthy 2004, and C. Gupta 2004). These issues likewise do not directly fall within the scope of this article.

It is not always possible to be precise about the number of Roman coins in particular hoards discovered in India, although it has often been estimated that nearly 6000 denarii have been found in the Indian subcontinent, while estimates of aurei range from roughly 1200 to 1550 (if the lost Kottayam and Parur hoards are included, then perhaps up to 10,550 aurei).[35] A significant majority of the denarii and aurei found in India were minted under the Julio-Claudian emperors. There are approximately 1400 coins of Augustus, 2500 of Tiberius, 35 of Gaius (Caligula), 300 of Claudius, and 200 of Nero (Sidebotham

35 For these estimates, see P. Turner 1989: 23, De Romanis 2012: 167, Tchernia 1995a: 1003, Tchernia 1995b: 154, Tchernia 1997b: 264, Whittaker 2004: 21, and Tomber 2009: 42; see also a report of 2000 well-preserved Roman gold coins from Ahmedabad (in Gujarat) that were purportedly discovered in the 1960s but which disappeared without detailed record; Rajgor 2004: 69; see also Appendix 3.

1986: 27 and Suresh 2004: 31, 160-77), meaning that almost two-thirds of these coins were minted in the Julio-Claudian period.[36]

The exact date when these coins were exported is a matter of controversy, as it is debated whether their wear results from circulation within the Roman Empire or in India. The good condition of a coin may indicate that it was exported soon after being minted and that it did not circulate much after its export, while a worn coin usually indicates some circulation (whether in the Roman Empire or in India) before burial or loss. It is also debated whether these coins were a regular item of export to India or were, instead, shipped in a concentrated period as the result of specific events within the Roman Empire. These issues need to be addressed in order to use these coins as a chronological indicator of Roman trade with India.

MacDowall has argued that most of the Roman coins found in India were exported as a result of the currency reforms of Nero (64 CE) and Trajan (107 CE) (1991: 145-53 and 1996: 81-92), that is, that Roman merchants saw the benefit of exporting older and heavier (and, in the case of the denarius, purer) coinage, which had the same notional value as the newer and lighter coins circulating in the Roman Empire but were treated as bullion in India, a process that MacDowall believes intensified as a result of Trajan's desire to remove old coins from circulation.[37] Burnett has argued, in addition, that Roman coins cannot be used as indices of trade and asserts that the process of selecting certain coins means that they came as large shipments rather than as continuous supplies (1998: 185-87; see also J. Meyer 2007: 60-61 and Mukherjee 2004: 2-3).

The main basis for Burnett's claim is the frequency of certain coin types, specifically those featuring Gaius and Lucius Caesar—25 percent of the Augustan coins appear to have been of this type—and the Pontifex Maximus type (minted under Tiberius).[38] The problem with this theory is, however, that the Gaius and Lucius issues were struck in immense numbers for more than 15 years (2 BCE-14 CE), and the Pontifex Maximus issues were minted uninterruptedly for near 23 years of Tiberius's reign (Mattingly 1923: lxxiii, cxiv, Sutherland and Carson (1984), 28, and MacDowall 2004a: 10). Most of these have been found in the Budinathan hoard, which contains 369 Gaius and Lucius denarii of Augustus and 1029 Pontifex Maximus denarii of Tiberius (MacDowall

36 De Romanis 2012: 167 asserts that 5728 denarii (6% are Republican, the rest almost all Julio-Claudian) and 1243 aurei can be reliably identified: 4435/(5728 + 1243) = 64%. See also Appendix 2.

37 Cassius Dio 68.15; in 107 CE Trajan recalled older, worn coinage to be melted down.

38 Gaius and Lucius: Roman Imperial Coinage (RIC) 2.207ff, Pontifex Maximus (PONTIF MAXIM) and RIC 2.25ff, and P. Turner 1989: 21.

1996: 87), potentially distorting the picture presented by Burnett. Moreover, while the Gaius and Lucius issues are common, more than 40 different types of Augustan coins have been found in India (Radhakrishnan 1999: 14-16).

The author of the *PME* does not regard coins as an unusual trade item but as a convenient form of gold and silver to export. It is not surprising that common recognizable, hence trustworthy, coins would be exported, as this would reduce the need to weigh and assay coins so frequently (MacDowall 1991: 147-9 and MacDowall 1996: 83, 89).[39] De Romanis has pointed out that the restriction of coin exports to the period after 64 CE contradicts Tiberius's purported complaint about the outflow of coins to foreign or hostile nations (CE 22). It also contradicts Pliny's account, situated in the reign of Claudius, of a freedman of Annius Plocamus, who, while sailing in the Red Sea, was accidentally blown off course to Taprobane (Sri Lanka) and subsequently impressed its king with his denarii minted by different emperors but of the same weight and purity (De Romanis 2012: 171, Tacitus, *Ann.* 3.53, and Pliny, *NH* 6.24.84).

MacDowall, to support his claim that many of these Roman coins were exported to India as a result of the aforementioned currency reforms, argues that many of these coins were worn. This is clearly the case for many of the Julio-Claudian aurei (see below), but the picture is mixed for the denarii. MacDowall notes that the Nasthullapur and Vellalur hoards have a lower weight range than the Akkenapalle hoard, which averages 3.3-3.8 grams. The weight ranges of the hoards at the former two sites are comparable to hoards buried during the Flavian period in the Empire (such as Bucklersbury House, in London, and Mildenhall, in Sussex).[40] He also notes that the hoard found in Budinathan has, among the many Augustan and Tiberian denarii, an Augustan denarius countermarked with IMP VESP (Imperator Vespasianus; MacDowall 1996: 87 and, contra, De Romanis 2012: 170-2). The 23 coins of the Pakli hoard that were not dispersed unrecorded among private dealers, show a mostly Republican to Tiberian range, but there is one denarius of Hadrian.[41]

Many reports, however, describe denarii surviving in relatively good and unworn condition. The Pollachi, Karur, Kathanganni, and Bangalore (HAL Airport) hoards are variously described as having high weights and being bold and distinct. Physical examination of the Budinatham and Akhilandapuram

39 For parallels in the exportation of coins in overland trade with the East, see De Romanis 2006: 59-69.

40 MacDowall 1996: 86: Vellalur 3-3.6g, some even less than 3g; also P. Turner 1989: 70-1: Nasthullapur: Augustan denarii 3-3.8g, Tiberian denarii 2.6-3.7g.

41 Five Republican consular coins, 1 Julius Caesar, 1 Mark Antony, 1 Brutus, 12 Augustus, 2 Tiberius, 1 Hadrian; see Singh 1988: 114.

hoards by Turner also shows denarii in relatively good and unworn conditions (P. Turner 1989: 15-6, Pl. v). In the Akkenapalle and Nasthullapur hoards, some coins are in better condition than others. Slash marks on the busts and punch marks, including Indian symbols, appear on a fair proportion of these coins.[42] Both of these hoards are, however, associated with monastic sites that may have acted as banking centres. Thus, their varied conditions and other features may result from their being assembled from a variety of different origins in India.[43] Sutherland and Carson suggest, as a rule of thumb, that silver coins in circulation tended to have only a 50-year lifespan, though others have argued for longer circulation (Sutherland and Carson 1984: 10, contra, MacDowall 1996: 82, MacDowall 2004a: 9, and Duncan-Jones 1994: 181, 191, 205, 210). It is not unlikely that the denarii that appear in hoards in good conditions were exported not long after they were minted, while even the slightly more worn denarii would have probably been exported during the first century, before such coins began to be removed from circulation (107 CE). Denarii thus appear to have been exported throughout the first century, not just after CE 64.

Few post-64 CE denarii have been found in India,[44] probably because of Nero's reduction in their weight (by 11 percent) and, more importantly, their purity from 97.35 percent (pre-reform) to 93.50 percent (post-reform); more recent analysis suggests a possible reduction to 80-90 percent.[45] This reduction in purity seems to have made Indian merchants less willing to receive post-64 CE denarii as an item of exchange, partly because they did not want to weigh and assay all these new, less trustworthy coins (Turner 1991: 26, MacDowall 1991: 149, and MacDowall 1996: 89). Merchants (Roman or otherwise) may have found it advantageous to continue to export the pre-64 CE denarii because their higher weight and purity meant a greater bullion value. MacDowall has related the statement in the *PME* about the exchange of Roman gold and silver

42 Percentage of slashed coins—Akkenapalle 98%, Nasthullapur 38%. Percentage of coins with punch marks—Akkenapalle 84%, Nasthullapur 10%—Suresh 2004: 42, 54 165, 169.

43 See Kulke and Rothermund 1986: 93, 99, 102, Morrison 1997: 95, Thapar 1978: 64, and P. Turner 1989: 15, 43, 120; Suresh 2004: 65 argues that, in Andra Pradesh, where some high-quality imitations of Roman coins circulated, these coins were used as currency (both imitation and genuine); for other arguments in favour of some level of circulation of Roman coins as gifts in India see De Romanis 2006: 69-82.

44 Exceptions include a denarius of Vespasian at Jabalpur (in Madhya Pradesh), one of Hadrian at Pakli, another from the Laccadive Island hoard, and about eight post-Neronian denarii now in the British Museum (Indian Office Collection); Suresh 2004: 35 and P. Turner 1989: 21.

45 Sutherland and Carson 1984: 4-5, 134 and Carson 1990: 224; for a recent reinterpretation of purity of post-CE 64 denarii, see Ponting 2009: 269-75.

coins at Barygaza for a profit to the fact that the ratio of value of gold to silver bullion was 1:12 before the 64 CE reform, compared with the 1:10 ratio observed in some parts of India (MacDowall 1996: 92 and *PME* 49; see also MacDowall 2004a and 2004b).

This reform seems to have increased the importance of gold coins as an export item by the late first century. Some have suggested that the currency reform of 64 CE did not directly affect the increased export of gold, pointing to the fact that the most common types found in India were those minted under the Julio-Claudians, especially Tiberius and Claudius, and that a shift in the preference for gold had already taken place (Suresh 2004: 34-5 and De Romanis 2012: 176). The possibility that some of these aurei were exported during the Julio-Claudian period should not be dismissed, especially in the light of the high-quality or mint-condition aurei found in hoards in the Madurai hills (in Tamil Nadu), Adam (in Maharashtra, 1 of Augustus, 10 of Tiberius), and Kottayam 1847 (in Kerala).[46] Most of the Julio-Claudian aurei are, however, worn to some degree, suggesting a gap between their minting and their export. That these Julio-Claudian aurei became worn due to circulation in the Roman Empire rather than in India is strongly suggested by the fact most of the aurei minted in the second century that reached India survive in relatively good condition, as seen at Athirala and Vinukonda, where the coins range from "fine condition" to "beautiful" (P. Turner 1989: 16). The second-century aurei are less numerous than the Julio-Claudian, although a slight increase in Severan aurei is apparent. These Severan aurei are, however, mostly worn and are often found alongside late Roman coins, indicating that they were probably exported in the Late Antique period (Berghaus 1991: 110-11).

Seven hoards with Julio-Claudian aurei (and an eighth with only second century aurei) reveal patterns in which the earlier coins are more worn, but the later they were minted, the better they are preserved. Turner noted that the Kaliyampattur hoard is reported to have contained worn Augustan to Claudian aurei and less worn Neronian aurei, alongside coins of Domitian that were in good condition. Similar patterns are seen in the Pudukottai and Nandyal hoards, suggesting that earlier Julio-Claudian aurei were in circulation longer before being buried with the later aurei (P. Turner 1989: 15; see Appendix 2). Suresh also noted this phenomenon at Kaliyampattur and Nandyal, as well as at Eyyal, Kumbalam, Nagavarappupadu, Nedumkandum, and Valuvally (Suresh 2004: 74 and P. Turner 1989: 15).

46 Suresh 2004: 74, 173, but, concerning the Adam hoard, MacDowall 1996: 91 suggests a burial date c. 70 CE, given the similarity in the weights of the coins to those in comparable hoards in the Roman Empire.

These eight hoards (referred to here collectively as batch-pattern hoards) represent almost three-quarters of the aurei finds in the Indian subcontinent (excluding the Kottayam hoard and the unidentified aurei of the Parur hoard—see Appendix 3). The latest aurei in these hoards range from issues of Nero to those of Marcus Aurelius, but there is a peak during the second half of the first century. Four of the hoards (the first group) were buried probably around the middle to late first century, while the other four (the second group) were buried around the first half of the second century (there is a 3:2 ratio in coin numbers between the first group and the second). In the aforementioned hoards, 66 percent of the identifiable coins are Julio-Claudian aurei, while only 2 percent are from Flavian emperors and 32 percent from the Nervan-Antonines.[47] The limited number of Flavian issues clearly indicates that merchants during the late first century—when they could still get hold of the heavier Julio-Claudian aurei—chose to export them, while the subsequent increase in Nervan-Antonine issues reflects the diminishing availability of the Julio-Claudian issues. That these were probably buried not long after arriving in India seems to be supported by the examination of the Valuvally hoard undertaken by Berghaus, in which 42 coins of Hadrian and Antoninus Pius have die-links ('coins struck by the same obverse/and or reverse dies'), suggesting limited circulation before burial (2004: 53-54).

It should not be assumed that these hoards represent original untouched trade batches, especially because some of them contain only a few coins, while many coins from the Pudukottai hoard revealed slash marks, and the Tondamanathan, Nagavarappupadu, and Eyyal hoards also contained local coins (Singh 1988: 104). The distribution of the coin hoards, mostly at inland sites, indicates that they were moved there via local trade networks, and as a result it is quite likely that original batches of coins once they had arrived in India were divided up and then redistributed. Indeed, many of the hoards are found in local lotas (earthenware pots) and have thus clearly been removed from their original consignments (Suresh 2004: 26). Nevertheless, the pattern displayed in these hoards is easier to explain as the result of circulation in the Roman Empire rather than in India; one might otherwise expect to find the coins in more variable condition. This is the case in the Akkenapalle and Nasthullapur hoards, where coins minted during the same reign survive in different conditions, probably because these hoards were associated with

47 The statistics behind these arguments are displayed in Appendix 2. The later-first-century coins that do appear tend to be the heavier aurei of Domitian and Nerva; MacDowall 2004a: 12.

monastic banking (see above). The coins in the batch-pattern hoards thus probably represent a portion removed from an original consignment.

The presence of some aurei of late-second and early-third-century emperors (specifically Commodus, Septimius Severus, and Caracalla) in hoards alongside first-century issues does raise questions about the arrival of the earlier coins in India. Of the 67 aurei finds identified, six (9% of the finds) fall into this category. These are the Daremavaripalem, Kadmat Island, Kottayam 1847, Sorayapattu, Veeravasaramu, and Vinukonda hoards (see Appendix 2). There are several issues with these hoards, however, that may counter the assumption that these earlier-first-century coins were being exported regularly with issues produced about 100-180 years later. Concerning the lost Kottayam 1847 hoard it is extremely unlikely that 8000 or more mint-condition aurei from the Julio-Claudian period were exported during the reign of Caracalla, on the basis of an individual identification of a coin of Caracalla by Dury, who was not present at the initial discovery.[48] Turner argues that this hoard was a Roman merchant's consignment, rather than a hoard assembled in India, citing the fact that the coins were in excellent condition, that many were found in a bronze vessel, and that it was a bimetallic hoard (a few denarii are reported to have been included) (Turner 9, 62-63). The fact that the hoard was found on the coast lends Turner's argument further plausibility (see Appendix 3).

Concerning the five other reported finds, some of those from Vinukonda are pierced by holes that were refilled later, indicating that they were used as jewellery at some point (Berghaus 1991: 110 and Suresh 2004: 79). The use of some of these coins as jewellery in India raises the possibility that they were assembled from different sources (as former personal adornments) in India rather than as part of a single original trade consignment. The 15 aurei from Kadmat Island contain five issues of Vespasian alongside nine of Antoninus Pius and one of Commodus, but these arrived in the Madras Museum as a result of the purchase by the "Collector of Canara," raising the question whether this is a "genuine hoard or specimens from a private collection" (P. Turner 1989: 57). The Daremavaripalem hoard contains one genuine coin each of Tiberius, Nero, and Domitian; the remainder are all cast, rather than die-struck, Indian imitations (Nero 1, Hadrian 2, Antoninus Pius 17, Commodus 1, and two unidentified), included alongside Indian gold jewellery (Suresh 2004: 59, 61, 64, 79-80, 166). Similarly, only a single coin of Tiberius from the Veeravasaramu hoard is genuine, the rest being Indian imitations of second-century coins, except for

48 A few descriptions of this hoard were published sometime after its discovery, but they were not particularly comprehensive in detail, and most of the coins were subsequently dispersed in the local markets—Suresh 2004: 41, 75; P. Turner 1989: 9.

one imitation of Caracalla or Geta (Turner 1989: 80-1). These imitation coins cannot be used as an indicator of when the first-century coins arrived in India but only of when they were finally buried. This leaves the 193 (or more) aurei from the Sorayapattu hoard that range from Tiberius to Caracalla, with an unknown number of imitations. The coins are reported to be in good condition, but there is an indication that some of these coins were pierced and used as jewellery, again raising the question, as with those from Vinukonda, about whether they were acquired from different sources within India (Suresh 2004: 59, 75, 77).

4.1 *Roman Coins as Indicators of Trade Fluctuations*

Some scholars have argued, largely on the basis of the number of Julio-Claudian denarii, that the Julio-Claudian period saw a peak in Roman trade with India.[49] In support of this view, De Romanis cites Tacitus's statement that many of the "old rich families, noble and illustrious, were often ruined by a passion for magnificence," but Vespasian ushered in a new age of moderation, with many new men (*homines novi*) who had been raised to the rank of senator emulating him.[50] However, Tacitus's comments were part of a common literary topos condemning profligacy and lavish spending and may be seen as representing an embellished desire to contrast Vespasian with Nero. The notion of the elite squandering its wealth certainly continued to find expression in contemporary comments from the later first century and beyond.[51]

The idea that the number of denarii represent a Julio-Claudian peak in trade is not sustainable, because, although the known finds are more numerous (outnumbering the aurei by roughly 4:1, excluding the lost the Kottayam and Parur hoards), the value and weight of the aureus were much greater than those of the denarius.[52] In the Roman Empire, one aureus was equal in value

49 See Bolin 1958: 72-74, P. Gupta 1991: 129, Tchernia 1997a: 238-49, and Tchernia 1997b: 250-83 (Italians exporting denarii); Sewell 1904: 593, 599-601, 605-7 and De Romanis 1997: 119-28 (Julio-Claudian peak in trade); De Romanis 2012.

50 Tacitus, *Annals* 3.55, translation from De Romanis 1997: 119-28; see also Suetonius, *Vespasian* 9.2 and Sewell 1904: 594, 617. Wallace-Hadrill 2008: 332 notes that the emperors may have thought it beneficial to allow the elite to destroy itself through competitive spending.

51 See especially Juvenal, *Satires* 1, lines 135-40 (fortunes on banquets), *Satires* 3, lines 180-83 (money borrowed for lavish displays), and Martial and Statius; see further, Athenaeus, *Deipnosophistae* 6.275b (third century CE) for the moralizing *topos* about former novelties and extravagance becoming common.

52 The pre-64 CE denarius was minted notionally at 3.9g (with minor reductions throughout Julio-Claudian period), the aureus at just under 8g; see Carson 1990: 14, 31-2.

to 25 denarii. This value ratio of gold to silver was not necessarily equivalent across the regions of India (see above), but gold was undoubtedly of significantly higher value. Lebedeva makes a similar point, although she believed the aurei were exported soon after being minted and therefore argued that the reign of Claudius saw the major peak of Roman trade in the Indian Ocean (1988: 51-2).[53] However, as shown above, the evidence indicates that the majority of the Julio-Claudian aurei are from hoards dating to about the middle to late first century, with a smaller number appearing alongside second-century CE aurei during the first half of the second century. The batch-pattern hoards show that the value (if not the volume) of coinage exported was greatest in the second half of the first century.

These coins represent only one segment of the trade and were received in India alongside a variety of other goods. Due to their density and high value, they would have taken up a negligible amount of space in a ship's hold (Cobb 2011: 225-8, 263-9). Nevertheless, the chronological patterns deduced from these coins correlates broadly with the patterns seen in the archaeological evidence for Roman goods in India and the occupation of the Roman ports on the Red Sea coast.

Conclusion

The archaeological evidence for Roman goods found across the Indian subcontinent, the southern Arabian Peninsula, and East Africa suggests that most of the goods were exported during the first century and that the second-century material is more limited. In addition, the most intensive occupation at the ports of Berenike and Myos Hormos also seems to have been during the first century. It has also been argued here that this consistent picture from the archaeological evidence can be supplemented by the patterns deduced from the numismatic evidence in India. The case has been made, on the basis of the batch-pattern hoards, for a Flavian peak in the value of Roman coins exported to India, with a downturn during the second century (perhaps not as dramatic as seen in the archaeological evidence). These patterns seem also to parallel the high level of building activity in the Flavian period in the praesidia along the routes across the Eastern Desert leading to the Roman Red Sea ports. Even if there are reservations about the more controversial numismatic evidence,

53 See also De Romanis 2012: 175, for the face-value ratio of pre-64 CE denarii and aurei, which he puts at 22% to 78% (just under 800 aurei and just over 5600 denarii).

this does not affect the well-founded picture drawn from the archaeological evidence of a first-century peak and second-century downturn.

This evidence can, of course, indicate only broad trends, and the literary sources offer little statistical data that would allow more detailed discussion of the volume of trade to different regions. Furthermore, these broad trends should not mask the annual fluctuations in the flow of goods between the Mediterranean and the Indian Ocean that would inevitably have been the result of variable weather, losses at sea, market conditions, bureaucratic delay, corruption, and the depredations of bandits and pirates. While a broad downturn in the involvement of Roman merchants and the exchange of Mediterranean goods in the Indian Ocean is apparent by the early second century, it does not follow that levels of trade or participation were insignificant by the mid to late second century, only that they were reduced. How sharp a reduction depends on whether you look at the archaeological evidence alone (which suggests a more pronounced drop) or in combination with the numismatic evidence as interpreted here (perhaps less dramatic).

Why did a downturn occur by the first half of the second century, before the Antonine plague or the crises of the third century? It is difficult to identify factors with certainty. There may have been a reduction in demand, but the literary sources offer only anecdotal evidence for the uses of and esteem for some Eastern goods in Roman society, not quantifiable information about demand. Written evidence about the demand for Roman goods in Indian and other eastern societies is even more limited. Another possible factor was the depredations of the barbaroi in the Eastern Desert, seen the in early-second-century ostraca from Krokodilo, which would have made transporting goods through this region increasingly difficult.

Or it may be that the evidence does not reflect simply a downturn but rather shifting patterns of trade. Archaeologically visible items, such as wine amphorae and crafted metals and glass, may have become less popular, while organic items such as textiles, drugs, and dyes may still have been significant, although this does not explain the decreasing value of Roman coin exports. Another possibility is that other routes, especially via the Persian Gulf, became more important for the transport of goods between the West and East,[54] perhaps indicating a decrease in direct Roman participation but not necessarily in demand for Eastern goods within Roman society. These hypotheses deserve further study.

54 For a comparison of the Red Sea and Persian Gulf routes, see Seland 2011.

Bibliography

Abraham, Shinu A. 2009. Strategies for Surface Documentation at the Early Historic Site of Pattanam, Kerala: The Malabar Region Archaeological Survey. In *Migration, Trade and People: Part 1*, ed. Roberta Tomber, Lucy Blue, and Shinu Abraham. London: 14-28.

Agarwala, Prakash N. 1985. *The History of Indian Business*. New Delhi: Vikas.

Alston, Richard. 1995. *Soldiers and Society in Roman Egypt*. London: Routledge.

———. 2007. Fraying Round the Edges: Models of Change on the Margins. In *Aspects of the Roman East*, ed. Richard Alston and Samuel N.C. Lieu. Brepols: Sydney: 1-32.

Bagnall, Roger S., Janet H. Johnson, Gene B. Gragg., Philip C. Hammon, Michael Dols, Galal el-Nahal, Carolyn G. Killean, Michael Bates, and Donald S. Whitcomb. 1979. Epigraphy. In *Quseir al-Qadim 1978: Preliminary Report*, ed. Donald S. Whitcomb and Janet H. Johnson Cairo: American Research Center in Egypt: 243-49.

Bagnall, Roger S., Christina Helms, and Arthur M.F.W. Verhoogt. 2000. *Documents from Berenike*. Vol. 1. Bruxelles: Fondation Égyptologique Reine Élisabeth.

Barnard, Hans, and Pamela J. Rose. 2007. Eastern Desert Ware from Berenike and Kab Marfu'a. In *Berenike 1999/2000 Report*, ed. Steven E. Sidebotham and Willamina Z. Wendrich. Los Angeles: Cotsen Institute of Archaeology: 183-99.

Begley, Vimala. 2004. Chronology. In *The Ancient Port of Arikamedu: New Excavations and Researches 1989-1992*. Vol. 2, ed. Vimala Begley. Paris: École Française d'Extrême-Orient: 1-16.

Berghaus, Peter. 1991. Roman Coins from India and Their Imitations. In *Coinage, Trade and Economy*, ed. Amal K. Jha. Nashik: Indian Institute of Research in Numismatic Studies: 108-21.

———. 2004. Evidence of Die-Links of Roman Coins and Their Indian Imitation Found in India. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha. Nashik: Indian Institute of Research in Numismatic Studies: 53-54.

Bernard, André. 1972. *De Koptos à Kosseir*. Leiden: Brill.

Bernstein, William J. 2008. *A Splendid Exchange*. New York: Atlantic Monthly Press.

Blue, Lucy. 2007. Locating the Harbour: Myos Hormos/Quseir al-Qadim: A Roman and Islamic Port on the Red Sea Coast of Egypt. *International Journal of Nautical Archaeology* 36/2: 265-81.

———. 2011. The Amphora Wharf. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea*. Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 35-42.

Blue, Lucy, Julian Whitewright, and Ross Thomas. 2011. Ships and Ships' Fittings. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea*. Vol. 2, ed.

David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 179-209.

Bolin, Sture. 1958. *State and Currency in the Roman Empire to 300 AD* Stockholm: Almqvist & Wiksell.

Bopearachchi, Osmund. 1996. Seafaring in the Indian Ocean: Archaeological Evidence from Sri Lanka. In *Tradition and Archaeology*, ed. Himanshu P. Ray and Jean-François Salles. New Delhi: Manohar: 59-77.

Bowersock, Glen W. 1983. *Roman Arabia.* Cambridge MA: Harvard University Press.

Bowman, Alan, and Andrew Wilson. 2009. Quantifying the Roman Economy: Integration, Growth, Decline? In *Quantifying the Roman Economy*, ed. Alan Bowman and Andrew Wilson: Oxford: Oxford University Press: 3-84.

Brancaccio, Pia, and Xinru Liu. 2009. Dionysus and Drama in the Buddhist Art of Gandhara. *Journal of Global History* 4/2: 219-44.

Brun, Jean-Pierre. 2006a. Chronologie de l'équipement de la route à l'époque gréco-romaine. In *Le route de Myos Hormos.* Vol. 1, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 187-205.

———. 2006b. Méthodes et conditions de fouille des fortins et des dépotoirs ou les affres d'un Gallo-Romain en Égypte. In *Le route de Myos Hormos.* Vol. 1, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 61-71.

Bülow-Jacobsen, Adam, Hélène Cuvigny, and Jean-Luc Fournet. 1994. The Identification of Myos Hormos: New Papyrological Evidence. *Le Bulletin de l'Institut français d'archéologie orientale* 94: 27-42.

Burnett, Andrew. 1998. Roman Coins from India and Sri Lanka. In *Origin, Evolution and Circulation of Foreign Coins in the Indian Ocean*, ed. Osmund Bopearachchi and Don P.M. Weerakkody. Sri Lanka: Manohar: 179-89.

Cambon, Pierre. 2011. Bagram: Alexandria of the Caucasus, Capital of the Kushan Empire. In *Afghanistan: Crossroads of the Ancient World*, ed. Fredrik Hierbert and Pierre Cambon. London: British Museum Press: 145-209.

Cappers, René T.J. 2006. *Roman Foodprints at Berenike.* Los Angeles: Cotsen Institute of Archaeology.

Carson, Robert A.G. 1990. *Coins of the Roman Empire.* London: Routledge.

Casson, Lionel. 1986. P. Vindob G 40822 and the Shipping of Goods from India. *Bulletin of the American Society of Papyrologists* 23/3-4: 73-79.

———. 1989. *The Periplus Maris Erythraei: Text with Introduction, Translation, and Commentary.* Princeton: Princeton University Press.

Chami, Felix A. 2000. Further Archaeological Research on Mafia Island. *Azania* 35/1: 214.

Cherian, P.J. 2009-10. Pattanam to Challenge Euro-Centric Notions and Help Rewrite the History of Indian Ocean Trade. *Journal of Indian Ocean Archaeology* 6: 153-58.

Cherian, P.J., G.V. Ravi Prasad, Koushik Dutta, Dinesh K. Ray, Veerasamy Selvakumar, and K.P. Shajan. 2009. Chronology of Pattanam: A Multi-Cultural Port Site on the Malabar Coast. *Current Science* 97/2: 236-40.

Cobb, Matthew A. 2011. *Roman Trade in the Indian Ocean during the Principate.* PhD diss. Swansea University.

Copeland, Penny. 2011. Metal and Metal Working. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 89-120.

Copeland, Penny, Ross Thomas, Paul Masser, James Philips, and Wilfried van Rengen. 2006. The Roman Town. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 1, ed. David Peacock and Lucy Blue. Oxford: Oxbow Books: 116-54.

Curtin, Philip D. 1984. *Cross-Cultural Trade in World History.* Cambridge: Cambridge University Press.

Cuvigny, Hélène. 2005. *Ostraca de Krokodilô. La correspondance militaire et sa circulation.* Cairo: Institut Français d'Archéologie Orientale.

———. 2006a. Introduction. In *Le route de Myos Hormos.* Vol. 1, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 1-35.

———. 2006b. Les documents écrits de la route de Myos Hormos à l' époque gréco-romaine (inscriptions, graffiti, papyrus, ostraca). In *Le route de Myos Hormos.* Vol. 2, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 265-94.

———. 2006c. Le fonctionnement du réseau. In *Le route de Myos Hormos.* Vol. 2, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 295-359.

———. ed. 2006d. *Le route de Myos Hormos,* vol. 1. Cairo: Institut Français d'Archéologie Orientale.

———. ed. 2006e. *Le route de Myos Hormos.* Vol. 2. Cairo: Institut Français d'Archéologie Orientale.

Cribb, Joe. 1992. Numismatic Evidence for the Date of the "Periplus." In *Indian Numismatics, History, Art, and Culture,* ed. David W. MacDowall, Savita Sharma, and Sanjay Garg. Delhi: Agam Kala Prakashan: 131-45.

Deloche, Jean. 1996. Iconographic Evidence on the Development of Boat and Ship Structures in India (2nd c. BC-15th c. AD): A New Approach. In *Tradition and Archaeology,* ed. Himanshu P. Ray and Jean-François Salles. New Delhi: Manohar: 199-224.

De Romanis, Federico. 1997. Rome and the *Notia* of India: Relations Between Rome and Southern India from 30 BC to the Flavian Period. In *Crossings,* ed. Federico De Romanis and André Tchernia. New Delhi: Manohar: 80-160.

———. 2006. *Aurei* after the Trade: Western Taxes and Eastern Gifts. In *Dal denarius al dinar: L'Oriente e la moneta romana,* ed. Frederico De Romanis and Sara Sorda: Rome: Istituto Italiano di Numismatica: 55-87.

———. 2012. Julio-Claudian *Denarii* and *Aurei* in Campania and India. *Annali dell'Istituto Italiano di Numismatica* 58: 161-92.

Dridi, Hédi. 2012. Appendix II: Radiocarbon Analysis of Splinters from the Wooden Tablet. In *Foreign Sailors on Socotra*, ed. Ingo Strauch. Bremen: Hempen: 461-62.

Düing, Walter. 1970. *The Monsoon Regime of the Currents in the Indian Ocean*. Honolulu: East-West Centre.

Duncan-Jones, Richard. 1994. *Money and Government in the Roman Empire*. Cambridge: Cambridge University Press.

Eide, Tormud, Tomas Hägg, Richard Holton Pierce, and Laszlo Török, eds. 1996. *Fontes Historiae Nubiorum*. Vol. 2. Bergen: University of Bergen.

Fraser, Peter M. 1972. *Ptolemaic Alexandria*. Vols. 1 and 2. Oxford: Clarendon Press.

Fournet, Jean-Luc. 2006. Langues, écritures et culture dans les *praesidia*. In *Le route de Myos Hormos*. Vol. 2, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 427-500.

Gorea, Maria. 2012a. Palmyra and Socotra. In *Foreign Sailors on Socotra*, ed. Ingo Strauch. Bremen: Hempen: 447-57.

———. 2012b. The Sea and Inland Trade of Palmyra. In *Foreign Sailors on Socotra*, ed. Ingo Strauch. Bremen: Hempen: 463-85.

Gupta, Chandrashekhar. 2004. Foreign Coins and Imitations Used for Ornamentation. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 115-20.

Gupta, Parmeshwari L. 1991. Coins in Rome's Indian Trade. In *Coinage, Trade and Economy*, ed. Amal K. Jha. Nashik: Indian Institute of Research in Numismatic Studies: 122-37.

Gupta, Sunil, David Williams, and David Peacock. 2001. Dressel 2-4 Amphorae and Roman Trade with India: The Evidence from Nevasa. *South Asian Studies* 17: 7-18.

Gurukkal, Rajan. 2013. Classical Indo-Roman Trade: A Historiographical Reconsideration. *Indian Historical Review* 40: 181-206.

Habicht, Christian. 2013. Eudoxus of Cyzicus and Ptolemaic Exploration. In *The Ptolemies, the Sea and the Nile*, ed. Kostas Buraseis, Mary Stefanou, and Dorothy J. Thompson. Cambridge: Cambridge University Press: 197-206.

Healy, John F. 1996. Palmyra and the Arabian Gulf Trade. *Aram* 8/1: 33-37.

Helm, Richard, Alison Crowther, Ceri Shipton, Amini Tengeza, Dorian Fuller, and Nicole Boivin. 2012. Exploring Agriculture, Interaction and Trade on the Eastern African Littoral: Preliminary Results from Kenya. *Azania* 47/1: 39-63.

Herbert, Sharon C., and Andrea Berlin. 2003. The Excavation: Occupation History and Ceramic Assemblages. In *Excavations at Coptos (Qift) In Upper Egypt, 1987-1992*, ed. Sharon C. Herbert and Andrea Berlin. *Journal of Roman Archaeology* Suppl. Ser. 53. Portsmouth RI: Journal of Roman Archaeology: 13-156.

Hierbert, Fredrik. 2011. The Lost Worlds of Afghanistan. In *Afghanistan: Crossroads of the Ancient World*, ed. Fredrik Hierbert and Pierre Cambon. London: British Museum Press: 55-64.

Horton, Mark C. 1996. Early Maritime Trade and Settlement along the Coast of Eastern Africa. In *The Indian Ocean in Antiquity*, ed. Julian Reade. London: Kegan Paul International: 439-59.

Hourani, George F., revised and expanded by John Carswell. 1995. *Arab Seafaring in the Indian Ocean in Ancient and Early Medieval Times*. Princeton: Princeton University Press.

Howgego, Christopher. 2009. Some Numismatic Approaches to Quantifying the Roman Economy. In *Quantifying the Roman Economy*, ed. Alan Bowman and Andrew Wilson. Oxford: Oxford University Press: 287-95.

Kennedy, David. 1985. The Composition of a Military Work Party in Roman Egypt (ILS 2483: Coptos). *Journal of Egyptian Archaeology* 71: 156-60.

Klemm, Rosemarie, and Dietrich Klemm. 2013. *Gold and Gold Mining in Ancient Egypt and Nubia*. Heidelberg: Springer.

Kulke, Hermann, and Dietmar Rothermund. 1986. *A History of India*. London: Routledge.

Lebedeva, Elena. 1988. India in Roman External Trade: The Evidence of Numismatics. *UNESCO International Association for the Study of the Cultures of Central Asia Information Bulletin* 14: 45-58.

Lindsay, William S. 1874. *History of Merchant Shipping and Ancient Commerce*. Vol. 1. New York: AMS Press.

Lombardi, Alessandra, Vittoria Buffa, and Alexia Pavan. 2008. Small Finds. In *A Port in Arabia: Between Rome and the Indian Ocean (3rd C. BC-5th C. AD): Khor Rori Report 2*, ed. Alessandra Avanzini. Rome: L'Erma di Bretschneider: 317-475.

MacDowall, David W. 1991. Indian Imports of Roman Silver Coinage. In *Coinage, Trade and Economy*, ed. Amal K. Jha. Nashik: Indian Institute of Research in Numismatic Studies: 145-63.

———. 1996. The Evidence of the Gazetteer of Roman Artefacts in India. In *Tradition and Archaeology*, ed. Himanshu P. Ray and Jean-François Salles. New Delhi: Manohar: 79-95.

———. 2004a. Foreign Coins Found in India: In View of the Monetary Systems Operating in the Countries of their Origin. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 9-14.

———. 2004b. The Indo-Roman Metal Trade. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 39-44.

Mahadevan, Iravatham. 1996. Tamil-Brahmi Graffito. In *Berenike 1995 Preliminary Report*, ed. Steven E. Sidebotham and Willamina Z. Wendrich. Leiden: Centre for Non-Western Study: 205-208.

Mattingly, Harold. 1923. *Coins of the Roman Empire in the British Museum*. Vol. 1. London: Published by the Trustees of the British Museum.

Mayerson, Philip. 1996. The Port of Clysma (Suez) in Transition from Roman to Arab Rule. *Journal of Near Eastern Studies* 55/2: 119-26.

Mazzarino, Santo. 1997. On the Name of the Hipalus (Hippalus) Wind in Pliny. In *Crossings*, ed. Federico De Romanis and André Tchernia. New Delhi: Manohar: 72-79.

McGrail, Seán. 2004. *Boats of the World from the Stone Age to Medieval Times*. Oxford: Oxford University Press.

McLaughlin, Raoul. 2010. *Rome and the Distant East*. London: Continuum.

Mehendale, Sanjyot. 2011. Bagram: At the Heart of the Silk Roads. In *Afghanistan: Crossroads of the Ancient World*, ed. Fredrik Hierbert and Pierre Cambon. London: British Museum Press: 131-43.

Meredith, David. 1952. The Roman Remains in the Eastern Desert of Egypt. *The Journal of Egyptian Archaeology* 38: 94-111.

———. 1953. The Roman Remains in the Eastern Desert of Egypt (Continued). *The Journal of Egyptian Archaeology* 39: 95-106.

Meyer, Carol. 1982. Large and Small Storerooms of the Roman Villa. In *Quseir al-Qadim 1980: Preliminary Report*, ed. Donald S. Whitcomb and Janet H. Johnson. Malibu: American Research Center in Egypt: 201-13.

———. 1992. *Glass from Quseir al-Qadim and the Indian Ocean Trade*. Studies in Ancient Oriental Civilization 53. Chicago: Oriental Institute of The University of Chicago.

Meyer, Jørgen C. 2007. Roman Coins as a Source for Roman Trading Activities in the Indian Ocean. In *The Indian Ocean in the Ancient Period*, ed. Eivind H. Seland. Oxford: Archaeopress: 59-68.

Millar, Fergus. 1998. Caravan Cities: The Roman Near East and Long-Distance Trade by Land. In *Modus Operandi: Essays in Honour of Geoffrey Rickman*, ed. Michel Austin, Jill Harries, and Christopher Smith. London: University of London, Institute of Classical Studies: 122-37.

Miller, James I. 1969. *The Spice Trade of the Roman Empire 29 BC to AD 641*. London: Oxford University Press.

Moore, Karl, and David Lewis. 1999. *Birth of the Multinational: 2000 Years of Ancient Business*. Copenhagen: Copenhagen Business School Press.

Mooren, Leon. 1972. The Date of SB V 8036 and the Development of the Ptolemaic Maritime Trade with India. *Ancient Society* 3: 127-33.

Mukherjee, Bratindra N. 2004. Some Aspects of Foreign Coins in the Indian Subcontinent. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 1-8.

Murray, George W., and Eric H. Warmington. 1967. Trogodytica: The Red Sea Littoral in Ptolemaic Times. *Geographical Journal* 133/1: 24-33.

Parry, John J. 1999. *The Seaports of Graeco-Roman Egypt: A Study of Their Positioning, Trade and Development.* PhD diss. University of Liverpool.

Peacock, David. 1993. The Site of Myos Hormos: A View from Space. *Journal of Roman Archaeology* 6: 226-32.

———. 2011a. Ceramic Lamps. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 47-56.

———. 2011b. Ptolemaic and Roman Coins. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 85-97.

Peacock, David, and Lucy Blue, ed. 2006a. *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 1. Oxford: Oxbow Books.

———. 2006b. The Excavations: Overview. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 1, ed. David Peacock and Lucy Blue. Oxford: Oxbow Books: 174-77.

Peacock, David, Lucy Blue, and Julian Whitewright, ed. 2011. *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2. BAR International Series 2286. Oxford: Archaeopress.

Peacock, David, Lucy Blue, and Darren Glazier. 2007. Review, Discussion and Conclusion. In *The Ancient Red Sea Port of Adulis, Eritrea*, ed. David Peacock and Lucy Blue. Oxford: Oxbow Books: 125-34.

Peacock, David, Lucy Blue, Paula Whittaker, Michael Walsh, and Ross Thomas. 2006. The Roman Harbour. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 1, ed. David Peacock and Lucy Blue. Oxford: Oxbow Books: 67-94.

Peacock, David, with contributions from Ismini Nina, Philip Kenrick, Jeroen Poblome, Roberta Tomber, and Kerlijne Romanus. 2007. Pottery from the Survey. In *The Ancient Red Sea Port of Adulis, Eritrea*, ed. David Peacock and Lucy Blue. Oxford: Oxbow Books: 79-108.

Ponting, Matthew. 2009. Roman Silver Coinage: Mints, Metallurgy, and Production. In *Quantifying the Roman Economy*, ed. Alan Bowman and Andrew Wilson. Oxford: Oxford University Press: 269-80.

Potts, Daniel T. 1990. *The Arabian Gulf in Antiquity.* 2 vols. Oxford: Clarendon Press.

Radhakrishnan, P.V. 1999. *Roman Gold & Silver Coins from India: A Collectors Guide.* Nashik: Indian Institute of Research in Numismatic Studies.

Rajgor, Dilip. 2004. Roman Currency in Gujarat. In *Foreign Coins Found in the Indian Sub-Continent,* ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 69-72.

Raschke, Manfred G. 1975. Papyrological Evidence for Ptolemaic and Roman Trade with India. In *Proceedings of the XIV International Congress of Papyrologists,* ed. Peter J. Parsons. Oxford: Egypt Exploration Society: 241-46.

Rathbone, Dominic. 1983. Italian Wines in Roman Egypt. *OPVS International Journal for Social and Economic History of Antiquity* 2: 81-98.

———. 2000. The "Muziris" Papyrus (SB XVIII 13167): Financing Roman Trade with India. In *Alexandrian Studies II in Honour of Mostafa el Abbadi,* ed. Mohammed Abd-el-Ghani. Alexandria: Societé Archéologique d'Alexandrie: 39-50.

Ray, Himanshu P. 2010. Sailing to India: Diverse Narratives of Travel in the Western Indian Ocean. In *The Athens Dialogues: Stories and Histories, Athens 25th-27th November 2010 (25th June 2010).* http://athensdialogues.chs.harvard.edu/cgi-bin/WebObjects/athensdialogues.woa/wa/dist?dis=35.

Reddé, Michel, and Jean-Pierre Brun. 2006. L'architecture des *praesidia* et la genése des dépotoirs. In *Le route de Myos Hormos.* Vol. 1, ed. Hélène Cuvigny. Cairo: Institut Français d'Archéologie Orientale: 73-185.

Rougé, Jean. 1986. La navigation intérieure dans le Proche Orient antique. In *L'Homme et l'eau en Méditerranée et au Proche Orient,* ed. Pierre Louis. Lyon: Maison de l'Orient: 39-49.

Rutten, Katrien. 2007. The Roman Fine Wares of ed-Dur (Umm al-Qaiwain, U.A.E.) and Their Distribution in the Persian Gulf and the Indian Ocean. *Arabian Archaeology and Epigraphy* 18: 8-24.

Salles, Jean-François. 1987. The Arab Persian Gulf Under the Seleucids. In *Hellenism in the East,* ed. Amelie Kurt and Susan Sherwin-White. London: Duckworth: 75-109.

———. 1995. The *Periplus* of the Erythraean Sea and the Arab-Persian Gulf. In *Athens, Aden, Arikamedu,* ed. Marie-François Boussac and Jean-François Salles. New Delhi: Manohar: 115-46.

———. 1996. Hellenistic Seafaring in the Indian Ocean. A Perspective from Arabia. In *Tradition and Archaeology,* ed. Himanshu P. Ray and Jean-François Salles. New Delhi: Manohar: 293-309.

Salmon, Richard. 1991. Epigraphic Remains of Indian Traders in Egypt. *Journal of the American Oriental Society* 111/4: 731-36.

Sarianidi, Viktor I. 2011. Ancient Bactria's Golden Hoard. In *Afghanistan: Crossroads of the Ancient World,* ed. Fredrik Hierbert and Pierre Cambon. London: British Museum Press: 211-17.

Satyamurthy, T. 2004. The Circulation of Foreign Coins in Southern India. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 55-57.

Schiltz, Véronique. 2011. Tillya Tepe, the Hill of Gold: A Nomad Necropolis. In *Afghanistan: Crossroads of the Ancient World*, ed. Fredrik Hierbert and Pierre Cambon. London: British Museum Press: 219-93.

Sedov, Alexander V. 1996. Qana' (Yemen) and the Indian Ocean. The Archaeological Evidence. In *Tradition and Archaeology*, ed. Himanshu P. Ray and Jean-François Salles. New Delhi: Manohar: 11-35.

———. 2007. The Port of Qana' and the Incense Trade. In *Food for the Gods*, ed. David Peacock and David Williams. Oxford: Oxbow Books: 71-111.

Seland, Eivind H. 2008. The Indian Ocean and the Globalisation of the Ancient World. *Ancient West and East* 7: 67-79.

———. 2010. *Ports and Political Power in the Periplus*. Oxford: Archaeopress.

———. 2011. The Persian Gulf or the Red Sea? Two Axes in Ancient Indian Ocean Trade: Where to Go and Why. *World Archaeology* 43/3: 398-409.

Selvakumar, Veerasamy, K.P. Shajan, and Roberta Tomber. 2009. Archaeological Investigations at Pattanam, Kerala: New Evidence for the Location of Ancient Muziris. In *Migration, Trade and People: Part 1*, ed. Roberta Tomber, Lucy Blue, and Shinu Abraham. London: British Academy: 29-41.

Sewell, Robert. 1904. Roman Coins Found in India. *Journal of the Royal Asiatic Society of Great Britain and Ireland* 36: 591-637.

Shastri, Ajay M. 2004. Some Aspects of Roman Coins in India. In *Foreign Coins Found in the Indian Sub-Continent*, ed. David. W. MacDowall and Amiteshwar Jha: Nashik: Indian Institute of Research in Numismatic Studies: 45-52.

Shaw, Ian. 2000. Egypt and the Outside World. In *The Oxford History of Ancient Egypt*, ed. Ian Shaw. Oxford: Oxford University Press: 308-23.

Sherwin-White, Susan, and Amelie Kuhrt. 1993. *From Samarkhand to Sardis*. London: Duckworth.

Sidebotham, Steven E. 1986. *Roman Economic Policy in the Erythra Thalassa 30 BC-AD 217*. Leiden: Brill.

———. 1989. Port of the Red Sea and the Arabia-India Trade. In *The Eastern Frontier of the Roman Empire*, ed. David H. French and Chris S. Lightfoot. BAR International Series 553. Oxford: BAR: 485-514.

———. 1991. Ports of the Red Sea and the Arabia-India Trade. In *Rome and India: The Ancient Sea Trade*, ed. Vimala Begley and Richard D. De Puma. Madison: University of Wisconsin Press: 12-38.

———. 1996. Roman Interests in the Red Sea and Indian Ocean. In *The Indian Ocean in Antiquity*, ed. Julian Reade. London: Kegan Paul International: 287-308.

———. 1999. The Coins. In *Report of the 1997 Excavations at Berenike*, ed. Steven E. Sidebotham and Willamina Z. Wendrich. Leiden: Centre for Non-Western Study: 183-99.

———. 2000. Coins. In *Report of the 1998 Excavations at Berenike*, ed. Steven E. Sidebotham and Willamina Z. Wendrich. Leiden: Centre for Non-Western Study: 169-78.

———. 2011a. *Berenike and the Ancient Maritime Spice Route*. London: University of California Press.

———. 2011b. Appendix 1: Ancient Coins from Quseir al-Qadim: The Oreintal Institute, University of Chicago Excavations 1978, 1980 and 1982. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea*. Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 353-60.

Sidebotham, Steven E., Martin Hense, and Hendrikle M. Nouwens. 2008. *The Red Land*. Cairo: The American University in Cairo Press.

Sidebotham, Steven E., and John A. Seeger. 1996. The Coins Catalogue. In *Berenike 1995 Preliminary Report*, ed. Steven E. Sidebotham and Willamina Z. Wendrich. Leiden: Centre for Non-Western Study: 179-96.

Sidebotham, Steven E., and Willamina Z. Wendrich, ed. 2007. *Berenike 1999/2000 Report on the Excavations*. Los Angeles: Cotsen Institute of Archaeology.

Sinclair, Paul J.J. 2007. What is the Archaeological Evidence for External Trading Contacts on the East African Coast in the First Millennium BC?. In *Natural Resources and Cultural Connections of the Red Sea*, ed. Janet Starkey, Paul Starkey, and Tony Wilkinson. Oxford: Archaeopress: 187-94.

Singh, Ajay. K. 1988. *Indo-Roman Trade*. New Delhi: Commonwealth Publishers.

Slane, Kathleen W. 1991. Observations on Mediterranean Amphoras and Tablewares Found in India. In *Rome and India. The Ancient Sea Trade*, ed. Vimala Begley and Richard D. De Puma. Madison: University of Wisconsin Press: 204-15.

Smith, Matthew C., and Henry T. Wright. 1988. The Ceramics from Ras Hafun in Somalia: Notes on a Classical Maritime Site. *Azania* 23: 115-41.

Smith, Richard L. 2009. *Trade in World History*. London: Routledge.

Strauch, Ingo, ed. 2012. *Foreign Sailors on Socotra*. Bremen: Hempen.

Strauss, Elisabeth J. 2007. *Roman Cargoes: Underwater Evidence from the Eastern Mediterranean*. PhD diss. University College London.

Suresh, Sethuraman. 2004. *Symbols of Trade Roman and Pseudo-Roman Objects Found in India*. Delhi: Manohar.

Sutherland, Carol H.V., and Robert A.G. Carson, ed. 1984. *The Roman Imperial Coinage*. Vol. 1. *From 31 BC to AD 69*. Rev. ed. London: Spink.

Syme, Ronald. 1995. *Anatolica: Studies in Strabo*. Oxford: Clarendon Press.

Tait, John G. 1930. *Greek Ostraka in the Bodleian Library at Oxford and Various Other Collections*. Vol. 1. London: Egypt Exploration Society.

Tchernia, André. 1995a. Moussons et monnaies: Les voies du commerce entre le monde gréco-romain et l'Inde. *Annales Histoire, Sciences Sociales* 50/5: 991-1009.

———. 1995b. Rome and India: Archaeology Alone? In *Athens, Aden, Arikamedu*, ed. Marie-François Boussac and Jean-François Salles. New Delhi: Manohar: 147-56.

———. 1997a. The Dromedary of the Peticii and Trade with the East. In *Crossings*, ed. Federico De Romanis and André Tchernia. New Delhi: Manohar: 238-49.

———. 1997b. Winds and Coins: From the Supposed Discovery of the Monsoon to the *Denarii* of Tiberius. In *Crossings*, ed. Federico De Romanis and André Tchernia. New Delhi: Manohar: 250-76.

Thapar, Romila. 1978. *Ancient Indian Social History: Some Interpretations*. London: Sangam Books.

———. 1997. Early Mediterranean Contact with India: An Overview. In *Crossings*, ed. Federico De Romanis and André Tchernia. New Delhi: Manohar: 11-40.

Thomas, Ross. 2011a. Roman Vessels Stoppers. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea*. Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 11-34.

———. 2011b. Terracotta Figurines. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea*. Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 79-83.

Tomber, Roberta. 2000. Indo-Roman Trade: The Ceramic Evidence from Egypt. *Antiquity* 74 (285): 624-31.

———. 2004. Rome and South Arabia: New Artefactual Evidence from the Red Sea. *Proceedings of the Seminar for Arabian Studies* 34: 351-60.

———. 2005. Trade Relations in the Eastern Mediterranean and Beyond: The Egyptian-Indian Connection. In *Trade Relations in the Eastern Mediterranean from the Late Hellenistic Period to Late Antiquity: The Ceramic Evidence*, ed. Maria B. Briese and Leif E. Vaag. Odense: University Press of Southern Denmark: 221-33.

———. 2007a. Bishops and Traders: The Role of Christianity in the Indian Ocean during the Roman Period. In *Natural Resources and Cultural Connections of the Red Sea*, ed. Janet Starkey, Paul Starkey, and Tony Wilkinson. Oxford: Archaeopress: 219-28.

———. 2007b. Rome and Mesopotamia: Importers into India in the First Millennium AD. *Antiquity* 81: 972-88.

———. 2008. *Indo-Roman Trade: From Pots to Pepper*. London: Duckworth.

———. 2009. Beyond Western India: The Evidence from Imported Amphorae. In *Migration, Trade and People: Part 1*, ed. Roberta Tomber, Lucy Blue, and Shinu Abraham. London: British Academy: 42-57.

Tomber, Roberta, David Graf, and John F. Healy, with contributions by Christiane Römer-Strehl and Grzegorz Majcherek. 2011. Pots with Writing. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 5-10.

Tripati, Sila. 2011. Ancient Maritime Trade of the Eastern Indian Littoral. *Current Science* 100/7: 1076-86.

Turner, Eric G. 1950. Papyrus 40 "della Raccolta Milanese." *JRS* 40: 57-59.

Turner, Paula J. 1989. *Roman Coins from India.* Royal Numismatics Society Spec. Publ. 22. London: Royal Society and Institute of Archaeology, University College.

Turner, Paula J., and Joe Cribb. 1996. Numismatic Evidence for the Roman Trade with Ancient India. In *The Indian Ocean in Antiquity*, ed. Julian Reade. London: British Museum: 309-19.

Van Der Veen, Marijke. 2011. *Consumption, Trade and Innovation.* Journal of African Archaeology Monogr. Ser. 6 Frankfurt am Main: Africa Magna.

Van Rengan, Wilfried. 2011. The Written Material from the Greco-Roman Period. In *Myos Hormos: Quseir al-Qadim Roman and Islamic Ports on the Red Sea.* Vol. 2, ed. David Peacock, Lucy Blue, and Julian Whitewright. BAR International Series 2286. Oxford: Archaeopress: 335-38.

Verhoogt, Arthur M.F.W. 1998. Greek and Latin Textual Material. In *Report of the 1996 Excavations at Berenike*, ed. Steven E. Sidebotham and Willamina Wendrich. Leiden: Centre for Non-Western Study: 193-98.

Villeneuve, François. 2007. L'Armée romaine en mer Rouge et autour de la mer Rouge aux IIéme et IIIéme siècles apr. J.C.: à propos de deux inscriptions latines découvertes sur l'archipel Farasan. In *The Late Roman Army in the Near East from Diocletian to the Arab Conquest*, ed. Ariel S. Lewin and Pietrina Pellegrini. BAR international Series 1717. Oxford: Archaeopress: 13-28.

Vogt, Burkhard. 1996. Bronze Age Maritime Trade in the Indian Ocean: Harrappan Traits on the Oman Peninsula. In *The Indian Ocean in Antiquity*, ed. Julian Reade. London: Kegan Paul International: 107-32.

Wallace-Hadrill, Andrew. 2008. *Rome's Cultural Revolution.* Cambridge: Cambridge University Press.

Warburton, David A. 2007. What Happened in the Near East ca 2000 BC?. In *The Indian Ocean in the Ancient Period*, ed. Eivind H. Seland. Oxford: Archaeopress: 9-21.

Ward, Walter. 2007. Aila and Clysma: The Rise of Northern Ports in the Red Sea in Late Antiquity. In *Natural Resources and Cultural Connections of the Red Sea*, ed. Janet Starkey, Paul Starkey, and Tony Wilkinson. Oxford: Archaeopress: 161-71.

Warmington, Eric H. 1928. *The Commerce between the Roman Empire and India.* London: Cambridge University Press.

Wheeler, Robert E.M. 1954. *Rome beyond the Imperial Frontiers.* London: Bell.

Whitcomb, Donald S. 1979. Trench Summaries. In *Quseir al-Qadim 1978 Preliminary Report*, ed. Donald S. Whitcomb and Janet H. Johnson. Cairo: American Research Center in Egypt: 11-65.

———. 1982. Roman Ceramics. In *Quseir al-Qadim 1980 Preliminary Report*, ed. Donald S. Whitcomb and Janet H. Johnson. Malibu: American Research Center in Egypt: 51-115.

Whitehouse, David. 1989a. Begram Reconsidered. *Kölner Jahrbuch für Vor- und Frühgeschichte* 22: 151-57.

———. 1989b. The Periplus and Gandharan Art. *Journal of Roman Archaeology* 2: 93-100.

Whitewright, Julian. 2008. *Maritime Technological Change and the Ancient World: The Invention of the Lateen Sail.* PhD diss. Southampton University.

Whittaker, Charles R. 2004. *Rome and Its Frontiers: The Dynamics of Empire.* London: Routledge.

Will, Elizabeth L. 2004. The Mediterranean Shipping Amphoras from the 1989-92 Excavations. In *The Ancient Port of Arikamedu. New Excavations and Researches 1989-1992*. Vol. 2, ed. Vimala Begley. Paris: École Française d'Extrême-Orient: 325-404.

Williams, David, and David Peacock. 2005. The Eruption of Vesuvius and Campanian Dressel 2-4 Amphorae. In *Terra Marique*, ed. John Pollini. Oxford: Oxbow Books: 140-48.

Wilson, Andrew. 2009. Approaches to Quantifying Roman Trade. In *Quantifying the Roman Economy*, ed. Alan Bowman and Andrew Wilson: Oxford: Oxford University Press: 213-49.

Wood, Frances. 2002. *The Silk Road: Two Thousand Years in the Heart of Asia.* Berkeley: University of California Press.

Young, Gary K. 2001. *Rome's Eastern Trade International Commerce and Imperial Policy, 31 BC-AD 305*. London: Routledge.

Appendix 1—Chronology of Settlement Patterns and Material Finds at Myos Hormos

This data is compiled from Copeland et al. 2006: 116-54; Peacock et al. 2006: 67-94; Blue 2011: 35-42; Copeland 2011: 89-120; Peacock 2011a: 47-56 and 2011b: 85-7; Thomas 2011a: 11-34; Thomas 2011b: 79-83; Blue, Whitewright, and Thomas 2011: 179-209; Van Rengan 2011: 335-8; Sidebotham 2011b: 353-60; van deer Veen 2011: 31-34.

Harbour Area

Location	Function	Establishment/use	Abandonment
Trench 7	Jetty	Late-first century BC to early-first century AD.	Possibly activity in early second century.
Trench 10	Metal workshop and furnaces	Intense activity from late-first century BC to late-first century AD.	Sometime during the second century.
Trench 12	Workshops	Late-first century.	Mid-second century.
Trench 14		Intense occupation mid-first century.	After mid-second century.
Trench 15	Mangrove clearance and sea-defences	Late-first century BC.	Falling into disuse before third century.

Town Area

Location	Function	Establishment/use	Abandonment
Trench 2	Civic building—possible synagogue?		Mid-late first century AD—used for animals during period of dilapidation possibly into second century.
Trench 8	Building—bakery	Structure built in first century AD—conversion to bakery in mid-second century.	Levelling of structures and rebuilding, large structure in north built in third century but rest of site abandoned.
Trench 17	Substantial official or private structure	First century AD occupation	Initial construction shows substantial investment, but part of building are later allowed to collapse, no evidence of later rebuilding.

Sebakh/*Rubbish Dump—Trench 6*

Section	Material	Date of Deposits
A-C	Vessels, glass, fine-ware pottery, some Roman coins, ostraka, and papyri.	First century.
D, E, K	Ceramics, equipment for vessels and fishing, and glassware, tapestry, craft-ware, and a significant quantity of ostraka and papyri.	Late-first to early-second century.
G-J	Equipment for maintenance of hulls, sailing rigging and fish equipment, amphorae stoppers with name of wine traders. Also fabrics, glass and ceramic wares, a ring with stone set in it, ostraka, papyri and equipment for writing, and some texts with references to trade.	Early-mid second century—small deposits in early-third century.
P	Initially have been levelled to make defensive structure.	Structure collapsed in mid-late first century and was not restored. During the late-first or early-second century there was dumping of rubbish in this location, which included shipping and fishing equipment, glass, metal and ceramic wares, some fragments of text with unidentified languages.
Q	Ropes, baskets and fishnets, some domestic rubbish, and ostraka, some showing Nabataean and Arabian script.	Limited ceramic evidence suggests early-mid first, or more likely late-first to early-second century period of dumping.

Material Finds

Material Finds	Numbers	Peak Periods
Amphorae stoppers	632	Imported western Mediterranean wine peaks in Augustan period, with decline by mid-first century—shift from imported to Egyptian products—rise in consumption in early-second century. A decline in amphorae products during second century.
Ceramic lamps	c.189 Roman	Majority date to Ptolemaic period and early-first century AD, while about 40 are dated to first and second century.
Terracotta figurines	24	The majority (19) have been identified by Thomas (2011b), on the basis of parallels, as belonging to the first century BC to early second century AD. While another 6 fit within a mid-first to second century date.
Brail rings (used in rigging)	169	Greatest concentration broadly from the mid-late first century contexts, with dip in early-second and, a comparatively more limited rise in mid-second century, and then a trailing off after this period.
Written material—papyri, ostraka, graffiti, dipinti, inscriptions	850 ostraka and 180 fragmentary papyri from 1999-2003 seasons (Southampton), 75 papyri and ostraka from 1978, 1980, 1982 (Chicago) seasons.	Written evidence ranges from early-first century to first-half of the third century AD—majority dates to the first century and early second century.

Material Finds	Numbers	Peak Periods
Ptolemaic and Roman coins	14 identifiable from the Southampton excavations, 154 from Chicago excavations—1 attributable Ptolemaic coin; 25 attributable Roman coins.	Many of coins in poor state of preservation, not allowing identification—of 14 identifiable coins from Southampton excavations, 1 Ptolemy VI Philometor; 2 Cleopatra VII; 4 Augustan; 1 Neronian; 3 Hadrian; 1 Antoninus Pius; 2 c. first-half of second century. From the Chicago excavations— 1 Ptolemy III; 1 Augustan; 1 Augustan or Claudian; 8 Claudian; 2 of Claudius or Nero; 1 Neronian; 1 c. Julio-Claudian; 1 Galba or Flavians; 2 Vespasian; 3 Domitianic; 1 Trajanic; 1 Hadrianic; 2 c, first-half of second century; 1 c. third century About 76% of Chicago finds belonging to Augustan period and first century AD, although if all Southampton finds are also included this goes down to 62.5%.

Appendix 2—Roman Aurei Found in the Indian Subcontinent

Date for this table has been collated primarily from P. Turner 1989 and Suresh 2004—see also Singh 1988 and De Romanis 2012. Note that in some cases data is not available in terms of description, weight, exact numbers, or circumstances of discovery.

Location	Number of Coins	Latest coin	Condition
Adam (Umred—Maharashtra)	11 (1 of Augustus)	Tiberius	Excellent Augustus 7.7g (grams) Tiberius 7.4-8g

(*cont.*)

Location	Number of Coins	Latest coin	Condition
Ahin Posh (Jalalabad—Pakistan)	3—Stupa deposit. 1 Domitian, 1 Trajan, 1 Hadrian. Found alongside 17 Kushan coins	Hadrian	Domitian 7.39g Trajan 7.16g Hadrian 6.81g
Akkialur (Kanataka)	3—found alongside 43 late Roman/Byzantine coins, and imitations	Caracalla (not including the late Roman/ Byzantine coins)	
Alamparai (Tamilnadu)?	2 (surface finds along with a copper coin)	?	
Alluru 1973 (Andhra Pradesh)	2—surface finds	?	
Alluru 1974-5 (Andhra Pradesh)	1—possibly a surface find	Claudius	
Athirala (Chitvelu—Andhra Pradesh)	1 (alongside old Hindu coin).	Trajan	Fine Trajan 7.01g
Bilaspur pre-1908 (Madhya Pradesh)	1	Septimius Severus	
Bilaspur 1911 (Madhya Pradesh)	3-1 Hadrian, 1 Commodus, 1 Septimius Severus	Septimius Severus	
Bishopsdown (Udhagamandalam—Tamilnadu)	1	Claudius?	
Chakherbedha (Bilsapur—Madhya Pradesh)	2-1 Commodus, 1 imitation of Antoninus Pius	Commodus	Very worn Commodus 6.933g
Daremavaripalem (Andhra Pradesh)	26-1 Tiberius, 1 Nero, 1 Domitian—remaining imitation coins	Domitian—however latest imitation is of Commodus	

Location	Number of Coins	Latest coin	Condition
Dharpul (Maharashtra)	18—earliest of Antonius Pius	Caracalla	
Eyyal (Kerala)	12—found alongside 71 denarii from Augustus to Nero + local coins	Trajan (8 of Tiberius, 2 Claudius, 1 Trajan, 1?)	Poor condition
Goa	1 Septimius Severus—12 others unidentified	Septimius Severus	
Gootiparti (Saryapet—Andhra Pradesh)	2-1 Claudius, 1 Trajan, 1 imitation of Antoninus Pius	Trajan (imitation Antoninus Pius)	Claudius—7.42g Trajan—6.9g Imitation of Antoninus Pius—6.93g
Gumada (Jeypore—Andhra Pradesh)	1—alongside 22 imitations	Septimius Severus (latest imitation of Constantine I)	
Guntur area (Andhra Pradesh)	3–surface finds, Nero, Trajan, Antoninus Pius	Antoninus Pius	
Idamakuduru (Kerala)?	1—not recorded whether it is a denarius or aureus	Claudius	
Junagadh (Gujarat)	1—surface find	Marcus Aurelius	
Kadmat Island (Lakshadweep)?	15-5 Vespasian, 9 Antoninus Pius, 1 Commodus	Commodus—There is uncertainty as to whether the hoard is genuine of the result of a private collection	All weigh between 6.95-7.47g.
Kaliyampattur (Tamilnadu)	63 (Tiberius to Nerva)	Nerva	Excellent preservation—(**batch pattern**)*

(*cont.*)

Location	Number of Coins	Latest coin	Condition
Kaprivani (Maharashtra)	2	Septimius Severus	
Karivalamvandanallur (Tamilnadu)	6-2 Nero, 1 Vespasian, 2 Domitian, 1 Hadrian	Hadrian	Weights descend from 7.17-7.02g (**batch pattern**)*
Karur 1806 (Tamilnadu)	5—Augustus, 1 Tiberius, 3 Claudius (surface finds)	Claudius	
Karur 1904 (Tamilnadu)	1 (surface find)	Marcus Aurelius	
Karur 1990 (Tamilnadu)	1 (alongside Chera coins)	Claudius	
Karur 1992 (Tamilnadu)	2 (possibly with 2 imitations)	Antoninus Pius	
Kondapur (Andhra Pradesh)?	1?—plus 1 lead coin of Tiberius and 2 imitations of Tiberius. This is alongside 1824 Satavahana coins and 10 punch-marked coins	Tiberius	Has a lead core and was used as jewellery.
Kottayam 1847 (coast of Kerala)	8,000—or at least thousands, of which 64 have been identified. It is reported that most were of Tiberius	Nero (possible 1 coin of Caracalla, and maybe other Antonines?—See Appendix 3).	Excellent preservation
Kottayam (Kerala)?	1–surface find	Nero	
Kumbalam (Kerala)	9-1 Hadrian, 4 Antoninus Pius, 4 Marcus Aurelius	Marcus Aurelius	Worn to improved condition—(**batch pattern**)*

Location	Number of Coins	Latest coin	Condition
Madurai pre-1998 (Tamilnadu)	1 (surface find)	Domitian	
Madurai Hills (Tamil Nadu)	11-5 Claudius, 3 Nero, 1 Domitian, rest?	Domitian	All weigh between 7.68-7.43g All of pre-reform (AD 64) weight standard.
Mallayapalem (Andhra Pradesh)	4—Surface finds, 1 Nero, 2 Trajan, 1 Antoninus Pius	Antoninus Pius	1 Nero 6.95g 1 Antoninus Pius 7.21g 2 Trajan?
Mandhal (Maharashtra)	6—surface finds of Augustus and Tiberius, ratio not specified	Tiberius	
Mangalore area (Karnataka)	?—unspecified number of coins of Antoninus Pius and Septimius Severus	Septimius Severus	
Manikyala 1886 (Islamabad—Pakistan)	5—found after ploughing, used in modern jewellery	Antoninus Pius	Worn
Mankada (Kerala)	1 (surface find)	Nero	
Mathura (Uttar Pradesh)	1—(surface find, reported)	Caracalla	
Memadakhedi (Ashta—Madhya Pradesh)	1 (surface find)	Septimius Severus	7g
Mysore (Kanataka)	1—a coin with no provenance was sold to the Madras Museum—now lost	Commodus	

(*cont.*)

Location	Number of Coins	Latest coin	Condition
Nagavarappupadu (Andhra Pradesh)	58 (Augustus to Nero)	Nero	Worn to improved condition—(**batch pattern**)*
Nagarjunakonda 1936 (Nalgonda—Andhra Pradesh)	1—surface find, alongside Satavahana coins	Hadrian	
Nagarjunakonda 1956 (Nalgonda—Andhra Pradesh)	2—found in excavations with Satavahana and Iksvaku coins	Antoninus Pius (other aureus of Tiberius)	
Nagdhara (Jalapur—Gujarat)	1—discovered in Bombay branch of Royal Asiatic Society	Marcus Aurelius	
Nandyal (Andhra Pradesh)	161—most lost, around 50 remain—2 Augustus, 17 Tiberius, 8 Claudius, 20 Nero, 1 Domitian, 2 Trajan, 2 Antoninus Pius	Antoninus Pius	Worn to improved condition —(**batch pattern**)* Weight range between 7.68-6.97g
Nellore 1786 (Andhra Pradesh)	40-30 recovered for study, found below Hindu temple	Gordian (includes Hadrian, Antoninus Pius, Gordian, rest?)	
Ongole (Guntur—Andhra Pradesh)	2-1 post-AD 64 Nero, 1 Hadrian (surface finds)	Hadrian	Nero—7.23g Hadrian—7.13g
Parur (Kerala)	1000 or more	None of the issues identified	
Peddakodamagundla (Gunter area—Andhra Pradesh)	3-1 Nero, 1 Hadrian, 1 Antoninus Pius	Antoninus Pius	

Location	Number of Coins	Latest coin	Condition
Peddabankur (Andhra Pradesh	9—coins of Augustus and Tiberius, an unspecified amount are imitations, alongside Satavahana coins	Tiberius	Genuine coins gold, imitations lead
Poonjar (Kerala)	6—surface find, 1 Augustus, 2 Claudius, 1 Nero, 2 Antoninus Pius, plus one denarius of Augustus	Antoninus Pius	
Pudukottai (Alangudi—Tamilnadu)	501-90% have slash marks, some in bad condition.	Vespasian	Worn to improved condition—(**batch pattern**)* Weights range from 7.84-7.6g (except for 2 Claudian coins of 7g)
Sampewada (Bhandara—Maharashtra)	1—alongside 1 unidentified imitation	Commodus	
Shevaki (Afghanistan)	1—Stupa deposit	Trajan	
Sorayapattu (Tamilnadu)	193—possibly more—(Tiberius to Caracalla, 42 Hadrian, 63 Antoninus Pius)	Caracalla	
Tadali (Bhandara—Maharashtra)	2 aurei—no record of which emperor(s)	?	
Taxila	1—Stupa deposit	Tiberius	

(*cont.*)

Location	Number of Coins	Latest coin	Condition
Tondamanathan (Cuddalore—Tamilnadu)	6—alongside local punch-marked coins	Nero	Worn to improved condition—(**batch pattern**)* Weight range from 7.73-7.47g
Uppavahr (Maharashtra)	2 or more?—1 Septimius Severus, plus 1 imitation, 1 Caracalla	Caracalla	
Valuvally (Karala)	314—surviving, the remainder stolen (Augustus to Antoninus Pius)	Antoninus Pius (possibly Marcus Aurelius)	Worn to improved condition—(**batch pattern**)*
Veeravasaramu (West Godavari—Andhra Pradesh)	1—alongside 14 imitation (mostly second century AD)	Tiberius	Tiberius 7.5g Imitations 7.13-6.7g
Vellalur 1939 (Tamilnadu)	3—possibly more—unknown provenance—found alongside gold jewellery	Tiberius	
Vinukonda (Andhra Pradesh)	15—found during excavations (Tiberius to Commodus)	Caracalla	All very well preserved 2 Tiberius—7.74 and 7.71g 1 Caracalla—7.25g
Waghoda (Jalgaon—Maharashtra)	1	Septimius Severus	
Yeleswaram (Andhra Pradesh)	1—excavated, alongside Satavahana coins	Septimius Severus	

The number of aurei in this table equates to almost 1,550 making allowances for a degree of uncertainty in reporting, and excluding imitation issues where identifiable.

The Composition of the Hoards Which May Reflect Trade Batches (In Ascending Date)*

These eight hoards show patterns which may be reflective of original trade consignments exported from the Roman Empire, in that they show earlier worn coins alongside fresher later coins. It is not, however, argued that these eight hoards represent original untouched trade batches, but it is argued that the patterns seen from these coins are much easier to explain as a result of circulation within the Roman Empire prior to export (see main article). Thus it is argued that these coins were exported as a batch soon after the *terminus post quem* provided by the latest coin.

(First Group—Latter half of first century)

Tondamanathan—Total of 6 coins—1 Augustus, 3 Tiberius, 1 Claudius, 1 Nero.

Pudukottai—Total of 501 coins—42 Augustus, 168 Tiberius, 14 Gaius, 156 Claudius, 116 Nero, 3 Vespasian, rest are unknown.

Nagavarappupadu—Total of 58 coins—6 Augustus (2 imitation Augustus), 21 Tiberius, 24 Claudius (1 imitation Claudius), 3 Nero, 1 unidentified coin.

Kaliyampattur—Total of 63 coins—6 Tiberius, 1 Gaius, 18 Claudius, 17 Nero, 5 Domitian, 2 Nerva, rest are unknown.

(Second Group—early to mid-second century)

Karivalamvandanallur—Total of 6 coins—2 Nero, 1 Vespasian, 2 Domitian, 1 Hadrian.

Nandyal—Total of 161 coins—2 Augustus, 17 Tiberius, 8 Claudius, 20 Nero, 1 Domitian, 1 Nerva, 2 Trajan, 2 Antoninus Pius, rest are unknown.

Valuvally—Total of 314 coins—Augustus ?, 6+ Nero, 7+ Vespasian, 2+ Domitian, 2+ Nerva, 27+ Trajan, 96+ Hadrian, 172 Antoninus Pius.

Kumbalam—Total of 9 coins—1 Hadrian, 4 Antoninus Pius, 4 Marcus Aurelius.

In terms of the total numbers—628 of these coins were exported broadly around the latter-half of the first century, while 409 were exported from the early-mid second century (1118 in total); this is a roughly 3:2 ratio. However, in terms of hoard finds four of them were buried around the latter-half of the first century AD and four in the second century AD. In terms of the number of identifiable coins of different emperors collectively represented in these eight hoards (998 coins) there are: 51 identified of Augustus (5% of the total), 215 of Tiberius (21.5%), 15 of Gaius (1.5%), 207 of Claudius (21%), 165 of Nero (17%), 11 of Vespasian (1%), 10 of Domitian (1%), 5 of Nerva (0.5%), 29 of Trajan (3%), 98 of Hadrian (10%), 178 of Antoninus Pius (18%), 4 Marcus Aurelius (0.5%). In terms of periods 66% were minted under Julio-Claudian emperors, 2% under Flavian

emperors, and 32% under Nervan-Antonine emperors, although this is primarily issues of Hadrian and Antoninus Pius. These distributions broadly reflect the general pattern of Roman coins finds in India, which is to say predominately worn Julio-Claudian aurei, with relatively fresh aurei of the first-half of the second century AD.

One other pattern that is important to note is that the Valuvally hoard which reveals the highest numbers of aurei issued in the second century AD, has a much lower proportion of Julio-Claudian aurei, while the Kumbalam hoard has no first century AD aurei. Conversely the hoards in the first group (Pudukottai, Nagavarappupadu, Kaliyampattur and Tondamanathan) reveal no second century aurei at all. This may be reflective of the decreasing amount of Julio-Claudian aurei available for export in the Roman Empire during the second century AD.[55] It seems to indicate that most of the Julio-Claudian aurei were exported during the Flavian period and the very beginning of the second century AD. This was in preference it appears to the Flavian issues, which only form 2% of the identifiable coins from these batch pattern hoards; no doubt because of the reduce weight of the aureus after AD 64. Therefore the fact that 66% or two thirds of identified aurei from these hoards are Julio-Claudian suggests that while our general date for the export of most of the aurei extends from Nero to Antoninus Pius (or Marcus Aurelius with the small Kumbalam hoard), the majority were probably exported in the late-first century and perhaps into the beginning of the second century.

Appendix 3—Kottayam Hoard

The reported discovery at Kottayam (in 1847) of what Turner has suggested was about "8,000" aurei, obviously has a major impact on any assessment about the peak period of export of Roman coins to India. A few descriptions of this hoard were published sometime after its discovery, but they were not particularly comprehensive in detail, and most of the coins were subsequently dispersed in the local markets. From the detail available it appears that many of the coins were in excellent condition, though a few coins were partly obliterated; it is not clear exactly to what this refers (Suresh 2004: 41, 75; P. Turner 1989: 9). Turner argues that this hoard was a Roman merchant's consignment, rather than a hoard assembled in India, citing the fact that the coins were in excellent condition, that many were found in a bronze vessel, and that it was

55 There was a recall of pre-Neronian aurei in AD 107—Cassius Dio 68.15; Carson 1990: 39; see also the scarcity of pre-AD 64 denarii and aurei in hoards found in the Vesuvian area and elsewhere in the western provinces—De Romanis 2006: 57; De Romanis 2012: 164-9.

a bimetallic hoard (a few denarii are reported to have been included).[56] The latter two features are extremely unusual among most hoards of Roman coins in India. Turner's theory cannot be taken as conclusive, but the fact that the hoard was found on the coast lends it further plausibility.

There is some evidence of the hoard's composition as a number of the coins were not lost, and a few reports describe them.[57] From the surviving evidence it seems the hoard was almost exclusively from Augustus to Nero, except for one coin which Drury describes as an issue of Caracalla, though he initially believed it to be one of Antoninus Pius, and perhaps implies that there was more than one coin of this emperor (Drury cited in P. Turner 1989: 62). As Turner notes 'the inclusion of such an issue in an otherwise exclusively Julio-Claudian hoard is hard to explain' (P. Turner 1989: 62). It seems most likely that Drury was mistaken in his identification, and it should be noted he was not present at the initial discovery. The Roman merchants acquired the coins they exported from ones already in circulation,[58] and given that this hoard comprised unworn Julio-Claudian aurei, it is extremely doubtful that they were assembled in the reign of Caracalla.[59] Julio-Claudian aurei only appear in two hoards (Sorayapattu and Vinukonda) alongside issues of Caracalla and do not exceed 13.5% of the total number of coins in either hoard.[60] It is also questionable whether the Sorayapattu and Vinukonda hoards reflect an original trade batch, given that a number of these aurei

56 Some coins may have been in bags that were subsequently destroyed—Suresh 2004: 26; P. Turner 1989: 9.

57 Several of the coins did make it to the Madras Museum, 80 to 90 went to the Rajah of Travancore, and some were eventually donated to the Asiatic society of Bengal. A total of 71 coins are described in the reports, some overlapping the Travancore collection—P. Turner 1989: 62.

58 Bolin 1958: 72-74, and Crawford cited in Tchernia 1995a: 1003, claims that the goods condition of many of the denarii indicated that they came directly from the mint. However, the absence of die links in most hoards makes it very unlikely they were acquired directly from the mint—MacDowall 1991: 147; MacDowall 1996: 83.

59 The operation of Gresham's Law would suggest that most Julio-Claudian coins would have disappeared from circulation well before the reign of Caracalla—see MacDowall 1991: 145-6, and 1996: 86; indeed, pre-Neroian aurei were recalled from circulation in AD 107—Cassius Dio 68.15; in addition recycling by Roman mints led to older issues disappearing—Carson 1990: 39; Ponting 2009: 276-7. It is also clear that Julio-Claudian aurei are much less frequent in hoards which have issues of the second century AD—see Appendix 2.

60 Sorayapattu (193 aurei, 3 of which are Tiberian, 5 Claudian, 18 Neronian)—Vinukonda (15 aurei of which 2 are Tiberian): Note in the Sorayapattu hoard the earlier the Julio-Claudian emperor the lower the number—see Appendix 2; also Suresh 2004: App. 1; Duncan-Jones 1994: 115, 195-96, notes that due to wastage older coins tend to be less numerous in hoards.

appear to have been used as jewellery (as seen from pierced holes), raising the possibility that they were assembled from different sources (see main article). Consequently if Turner is correct in identifying the Kottayam hoard as a lost trade consignment of a merchant, given their excellent state of preservation, and the fact that the latest coins were (probably) those of Nero, this hoard would likely have been exported either during the reign of Nero or at some point in the Flavian period.

It is possible to regard the Kottayam hoard as a fluke discovery or anomaly which skews the rest of the results. However, there is clear overlap between the proposed date of the Kottayam hoard (c. mid-late first century AD), and the "batch pattern" hoards which appear to reflect the pattern of aurei exports as a whole (roughly AD 55-160, with a preponderance in the first century).[61] Consequently whether one wishes to include the Kottayam hoard or not, the main peak in the trade, as reflected from the coins, still appears to be the second-half of the first century.

61 See Appendix 2.